Electrical Review

With Which Is Consolidated WESTERN ELECTRICIAN and ELECTROCRAFT.

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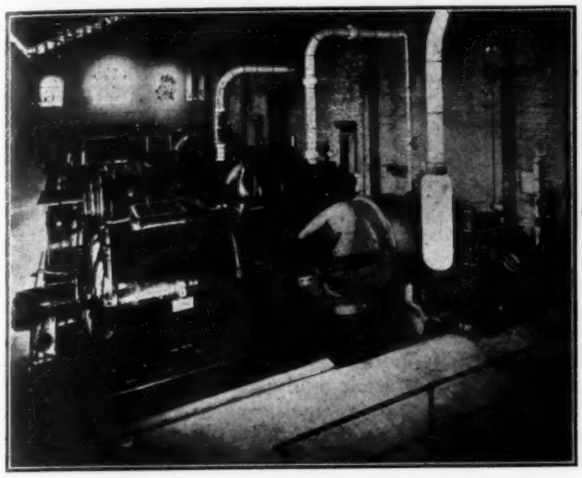
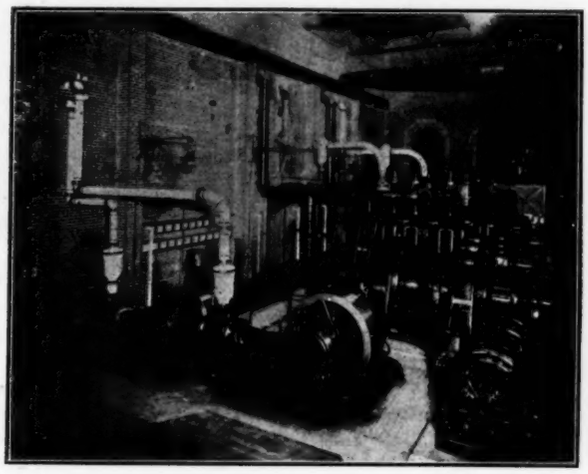


Alternating-Current Turbogenerators Supplying the Three-Phase System.



Engine-Driven Direct-Current Generators for Street-Railway System, Exciter Sets and Motor-Generator.

The Central Station at Calgary

Municipal Electric Plant of Enterprising Western Canadian City—Hydroelectric and Steam-Generated Power Supplied to Street Railway and to Light and Power Customers

By JAMES F. Mc CALL,

Superintendent and Chief Engineer.

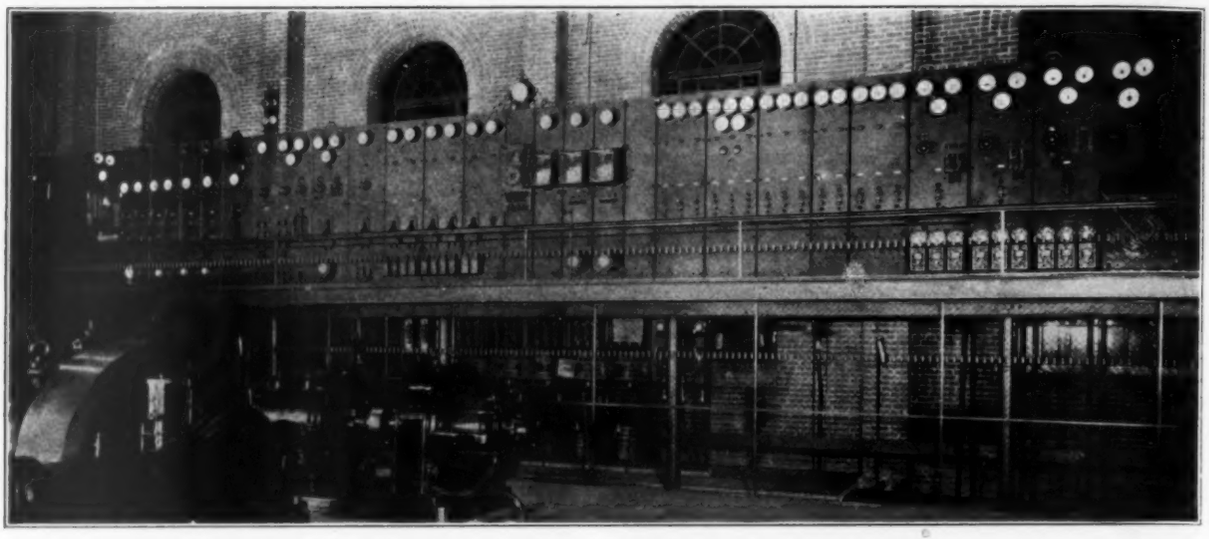
CALGARY is the largest city in the province of Alberta and one of the most enterprising and rapidly growing communities in the great expanse of western Canada. In 1901 its population was 4400, in 1911 it was 43,700, whereas in 1916 it was estimated as over 80,000. Although the war has checked the development of the city, it has not been affected nearly as much by this international disturbance as most other Canadian cities. One reason for this is that quite a few important industries are represented in the city, including large shops of the Canadian Pacific Railway, lumber, flour and other food-product mills, packing plants, soap works, cement mills, etc.

Power is available in Calgary at quite low cost, which accounts largely for its rapid industrial growth. Hydroelectric power is secured from the Bow River plant of the Calgary Power Company, Limited, about 50 miles west of the city. Steam power is also developed in the city, both natural gas and coal being available in large quantities from nearby. In 1905 the first municipal electric light and power plant was built and in the following years added to from time to time, until 1911, when the first part of the city's new steam plant was built at a favorable point on the river.

The Calgary Power Company completed its hydroelectric plant soon after and entered into a contract to furnish the city with part of its power supply. The present contract calls for furnishing 5000 horsepower. This power is generated at 12,000 volts and stepped up to 55,000 volts for transmission from the water-power plant to the company's terminal station at East Calgary, where it is again stepped down to 12,000 volts and sent to the city's stations. Besides the up-to-date steam-electric station, the city has four substations in various parts of the city from which the power is locally distributed. All energy supply is three phase, 60 cycles, both that derived from the hydroelectric supply referred to and that generated in the steam plant, except that direct current at 550 volts is also supplied to the municipal street-railway system.

GENERAL FEATURES OF THE CITY'S CENTRAL STATION.

The municipal steam plant is known as "Central Station." It is operated more or less as a standby station throughout the year, especially during the long and cold winter experienced here when low water at the water-power plant coincides with the peak load on the city's distribution system. The station is kept in readiness to pick up the full load in any emergency



Switchboard in the Calgary Municipal Electric Light and Power Station.

at any time and during winter days carries a large part of the entire load.

A well built brick and steel building houses the station, which has the engine and boiler rooms parallel, they being separated by a two-foot brick wall. The engine room is 260 by 50 feet and the boiler room 260 by 83 feet.

Fuel-Handling Equipment and Boilers.

Coal is unloaded from the cars into a 40-ton hopper outside the boiler room. From this hopper it is conveyed by a tray conveyor to the main bucket conveyor which dumps the coal into steel bunkers overhead. This same bucket conveyor carries away the ashes from the basement below the boilers and discharges them outside the building. The coal and ash-handling apparatus was manufactured by the C. W. Hunt Company, and erected by Phillips, Lang & Company, Chicago, which firm also furnished and erected all the steel in the power-house building.

Steam is furnished by 20 Babcock & Wilcox water-tube boilers of several sizes, the heating surfaces of which range from 2823 to 6000 square feet. The boilers are arranged in two rows on either side of a central firing aisle. Each boiler is equipped with a Babcock & Wilcox chain-grate mechanical stoker. During the summer part of the boilers are arranged for burning natural gas, for which the demand is not so great throughout the city as during the winter season. There are two relatively short steel stacks, one for each row of boilers, and induced draft is furnished by the Canadian Buffalo Forge Company's draft fans, part of which are steam-driven and part motor-driven. No economizers are used. The working pressure of the boilers is 160 pounds.

Turbine and Engine-Driven Generating Sets.

The generating equipment is of two types: for the general light and power supply it is composed of steam-turbine-driven, three-phase, 2300-volt generators; for the street railway it is composed of engine-driven, 550-volt, direct-current generators. The alternating-current machines are at one end of the engine room and the direct-current machines at the other end.

Three alternating-current generating sets are provided, as follows: One 5250-kilowatt and one 1800-kilowatt turbogenerator supplied by Allis-Chalmers, Limited, each operating at speed of 1800 revolutions per minute, and each equipped with a Wheeler condenser and auxiliaries, including a Mullan air pump; one 2500-kilowatt steam turbine supplied by Bellis & Morcom, Limited, direct-connected to a generator supplied by the firm of Vickers, Limited, both of England. Each of these three sets is rated at 80 per cent power-factor. For these alternators there are provided three exciter units, as follows: One 100-kilowatt Westinghouse generator direct-connected to a 150-horsepower Robb engine; one 50-kilowatt Allis-Chalmers-Bullock generator direct-connected to a 75-horsepower Robb engine; one 100-kilowatt motor-driven exciter generator. The excitation voltage is 120.

There are two direct-current railway generating sets, each consisting of a 1000-horsepower three-cylinder vertical engine built by the Robb Engineering Company, Limited; one of these is connected to a 600-kilowatt, Dick-Kerr generator, and the other to an Allis-Chalmers-Bullock generator. At this station there is also for the railway system a 1000-kilowatt motor-generator set, consisting of a three-phase synchronous motor and a 550-volt direct-current generator; this set was supplied by Dick, Kerr & Company, Limited, of England.

Electrical Features.

At a substation about 1½ miles west of Central Station are two 1000-kilowatt synchronous motor-generator sets similar to the one just referred to, but of the self-starting type and supplied by the Swedish General Electric Company. At the substation at Ogden, about 4 miles east of Central Station, there are two synchronous motor-generator sets, one of 500 and one of 300 kilowatts.

This combination of synchronous sets has been found to give a very good distribution of the power for the street-railway lines. The prime reason for employing synchronous motors for motor-generator sets is for power-factor correction, as the city's contract with the Calgary Power Company calls for the maintenance of a 90-per-cent power-factor on the system.

The switchboard is mounted on a concrete and steel gallery at one side of the engine room. This gal-

lery is 70 by 12 feet in dimensions and is supported by iron columns. The switchboard consists of 25 panels, all the instruments on which were supplied by the Canadian Westinghouse Company, Limited. All high-tension switches are of the remote-control oil type with a rupturing capacity of 45,000 volts; they were furnished by the Canadian General Electric Company, Limited; 20 of them were located on a section of the main floor of the station. The bus structures are in a fireproof compartment in the basement immediately below the remote-control switches. Main and auxiliary buses are provided and every feature of the connections and switching is arranged in such a way that it is practically impossible to have a tie-up through the failure of any particular switch or section.

All the machine circuits are protected by time-limit relays and reactance coils. All the main power circuits, both incoming and outgoing, are equipped with up-to-date time-limit relays. Three 3000-kilowatt transformers located in special fireproof compartments in the basement step down the potential of the 12,000-volt hydroelectric lines to that of the 2300-volt buses. All circuits leave and enter the station in lead-covered cables carried on racks fastened to the walls of a concrete subway that leads to a tower about 150 feet from the station.

Lightning arresters are of the Westinghouse electrolytic type and are located in a separate brick building near the station. The storage-battery plant for operating remote-controlled oil switches in case of emergency is also in the same building. The swichboard and distribution system was designed and erected under the direction of R. A. Brown, the city's electrical engineer.

Features of the Service.

In the central part of the city electricity for light and power is supplied by a private company, which had a franchise before the municipal plant was established. Another company has a franchise to supply natural gas throughout the city at 35 cents per 1000 cubic feet. Considerable residence lighting as well as nearly all the cooking and much heating is therefore done by natural gas. In spite of this competition, the load on the municipal electric plant has rapidly increased. The plant supplies all of the city's own electrical needs for street lighting, for light and power in its buildings, and for its street-railway lines, and it sells energy at low rates for light, heat and power to its citizens.

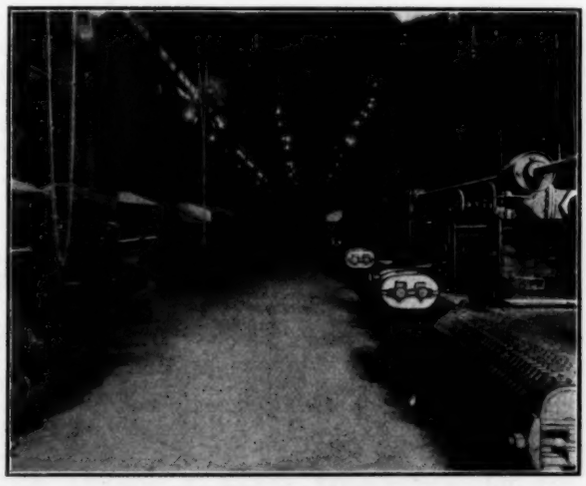
In February, 1915, the rates were reduced. For lighting service the rates are as follows: For the first 1000 kilowatt-hours, 5 cents per kilowatt-hour; for all in excess, 4 cents per kilowatt-hour, subject to discount of 10 per cent if paid within 10 days from date of monthly bill; the minimum charge is 75 cents if the connected load does not exceed one kilowatt, and 50 cents in addition for each additional kilowatt of connected load. A flat-rate service is also available for lighting, the monthly charge being 50 cents for each of the first 20 16-candlepower lamps, and 40 cents for each additional 16-candlepower lamp.

The power rates are as follows: For the first 750 kilowatt-hours, 2 cents per kilowatt-hour; for the next 1000 kilowatt-hours, 1.8 cents each; for the next 1750 kilowatt-hours, 1.6 cents each; for the next 9000 kilowatt-hours 1.3 cents each; all over 12,500 kilowatt-hours, 1.1 cents each; when energy is used off-peak only and exceeds 130 kilowatt-hours per connected horsepower per month, a discount is allowed ranging from 5 to 15 per cent, the latter being for consumption exceeding 300 kilowatt-hours per connected horsepower per month; the minimum monthly power charge is 50 cents per horsepower of connected load. Where a considerable amount of energy is used for heating or lighting during off-peak hours, a two-rate meter may be installed; in this case the standard lighting rate applies to the consumption during the peak hours and the power rate to that off-peak.

A deposit may be required from all applicants for electric service as security for payment of bills; the amount of it is based on the average consumption for two months. The city also has the right to disconnect the service for nonpayment of bills. The city supplies all lighting-service transformers and also power-service transformers for 220-volt motors below 50 horsepower. For all motors of 50 horsepower and over that are not designed for 2300 volts, the customer must furnish his own transformers, which must be of type approved by the city electrician.

The Calgary Electric Light & Power Department, which has charge of the city's plant and distribution system, and the Street Railway Department, which operates the street-car lines, are providing services that have been favorably commented on by visitors and citizens alike. The administration is on a strictly business basis and free from political interference. Energy furnished to the municipality for street lighting and operation of street-car lines is charged to these departments on an equitable basis.

Coal and Ash-Handling Bucket Conveyor.



View in Boiler Room of Calgary Central Station.

The Inductance of Tubular Conductors

Derivation of a Fairly Simple Formula for Inductance of Tubular Buses and the Like—Skin Effect and Comparison of Solid Wires and Tubes

By H. B. DWIGHT

A TUBE is one of the most economical forms of conductor for high-frequency current, since the skin-effect losses in a tube are less than in almost any other type of conductor, when the return conductor is not close to it. Accordingly, a formula for the inductance of circuits using tubular conductors is of interest. Such a formula is derived and illustrated by examples in this article.

The section of a tubular conductor is shown in Fig. 1. Assume that the dimensions are in centimeters, and that there is a current of uniform density a_0 in absamperes, or absolute units of current, per square centimeter of section. The current inside the circle of radius x is

$$I_x = \pi a_0 (x^2 - q^2) \text{ absamperes} \quad (1)$$

The flux density at radius x is

$$\left(\frac{2I_x}{x} = 2\pi a_0 \left(x - \frac{q^2}{x}\right)\right. \quad (2)$$

The total flux in the ring outside the circle of radius x is

$$\phi_x = 2\pi a_0 \int_x^r \left(x - \frac{q^2}{x}\right) dx$$

$$= \pi a_0 \left(r^2 - x^2 - 2q^2 \log_h \frac{r}{x}\right) \quad (3)$$

The reactive drop at radius x, due to flux inside the conductor, is

$$j\omega\phi_x = j\omega\pi a_0 \left(r^2 - x^2 - 2q^2 \log_h \frac{r}{x}\right) \text{abvolts} \quad (4)$$

where $\omega = 2\pi f$ and where f is the frequency in cycles per second.

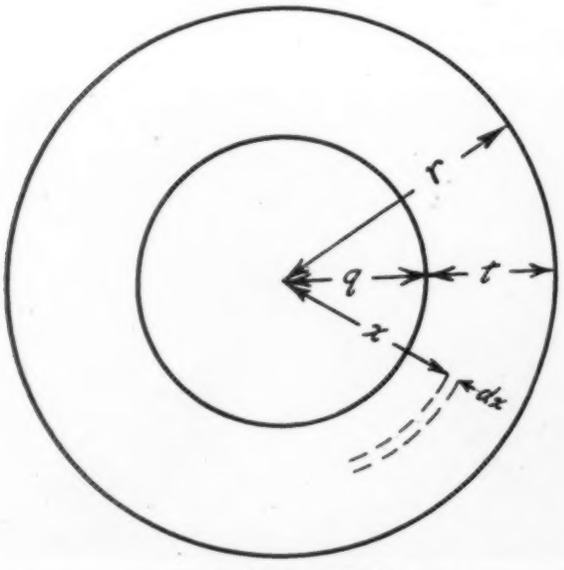


Fig. 1.—Section of Tube.

To find the average reactive drop, multiply each element of area by the drop in that element, integrate over the section of the tube, and divide by the total area. This process is in agreement with the method by which the skin effect in a tube is calculated.

The element of area is $2\pi x dx$ and the total area of the section is $\pi (r^2 - q^2)$.

Then the average reactive drop due to flux inside the conductor is

$$\frac{1}{\pi (r^2 - q^2)} \int_q^r j\omega\pi a_0 \left(r^2 - x^2 - 2q^2 \log_h \frac{r}{x}\right) 2\pi x dx \text{ abvolts}$$

$$= \frac{2 j\omega\pi a_0}{r^2 - q^2} \left(\frac{r^4}{4} - q^2 r^2 + \frac{3q^4}{4} + q^4 \log_h \frac{r}{q}\right) \text{abvolts}$$

$$= \tfrac{1}{2} j\omega\pi a_0 \left(r^2 - 3q^2 + \frac{4q^4}{r^2 - q^2} \log_h \frac{r}{q}\right) \text{abvolts}$$

$$= \tfrac{1}{2} j\omega I \left[\frac{r^2 - 3q^2}{r^2 - q^2} + \frac{4q^4}{(r^2 - q^2)^2} \log_h \frac{r}{q}\right] \text{ abvolts} \quad (5)$$

where $I = \pi a_0 (r^2 - q^2)$, the total current in absamperes. In the case of a solid wire, $q = 0$, and formula (5) reduces to the well known expression,

$$1/2\ j\omega I \text{ abvolts} \quad (6)$$

A convergent series in t/q (see Fig. 1), which has been derived from (5), gives accurate results with tubes of ordinary thickness, as follows:

The average reactive drop due to flux inside the conductor is

$$= \tfrac{1}{2} j\omega I \frac{t^2}{(2qt + t^2)} \left[\frac{8}{3} - \frac{4}{3}\frac{t}{q} + \frac{16}{15}\frac{t^2}{q^2} - \frac{13}{15}\frac{t^3}{q^3} + \ldots\right] \text{abvolts} \quad (7)$$

Formulas (5) and (7) are in agreement with the formula for skin effect in a tube. The results are

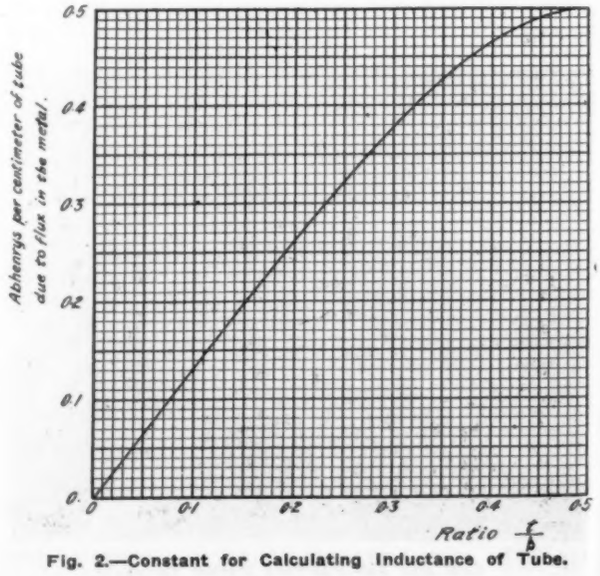


Fig. 2.—Constant for Calculating Inductance of Tube.

plotted in the curve of Fig. 2, from which values can be read accurately enough for most purposes.

The complete formula for inductance of parallel tubes, not close together, is obtained by adding the effect of flux between the conductors, and is

$$L = \tfrac{1}{2}\left\{\frac{r^2 - 3q^2}{r^2 - q^2} + \frac{4q^4}{(r^2 - q^2)^2}\log_h \frac{r}{q}\right\} + 2\log_h \frac{s}{r} \qquad (8)$$

abhenrys per centimeter of tube, where s is the axial spacing in centimeters. The result in henrys is obtained by multiplying formula (8) by 10^{-9}.

An alternative method of obtaining the result is to use Maxwell's formulas for geometrical mean distances,* the inductance being proportional to the difference between the geometrical mean distance of one section from the other, and that of all pairs of points on one section.

At high frequency, the current crowds toward the outside surface of the tube, due to skin effect, and the part of the inductance due to flux inside the metal is decreased. When the tube is close to the return conductor, the current tends to crowd into the part nearest the return conductor, due to proximity effect, and a change in the inductance takes place from this cause also.

As an example of the formulas of this article, a single-phase circuit may be considered, composed of tubes of one-inch outside diameter and one-tenth-inch wall, spaced 20 inches center to center. The inductance, neglecting skin effect and proximity effect, is given by

$$L = 0.133 + 2\log_h 40 = 7.51$$

abhenrys per centimeter of tube. This is equal to 0.000229 henry per 1000 feet of tube.

If the tube were infinitely thin, the term 0.133 would become zero, and the inductance would become 0.000225 henry, or 2 per cent less. This is the lowest value to which skin effect, but not proximity effect, could reduce the inductance.

Solid wire of one-inch diameter would have an inductance of 0.000240 henry, or 5 per cent more than the tube.

Solid wire of the same area of section as the tube would have a diameter of 0.6 inch, and an inductance of 0.000271 henry per 1000 feet of wire, which is 18 per cent higher than the inductance of the tube.

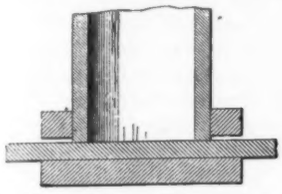
It is seen that the use of tubes instead of wires of the same sectional area not only reduces the skin-effect resistance losses to a low figure, but reduces the amount of the inductive drop by a considerable percentage.

*Electricity and Magnetism, by J. Clerk Maxwell, Vol. II, paragraph 692.

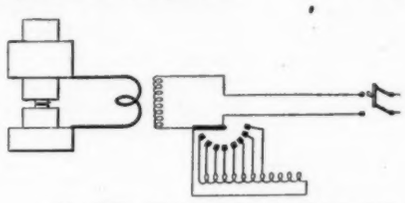
INNOVATIONS IN ELECTRIC WELDING.

Series of Patents Recently Issued on New Ideas in Electric Welding.

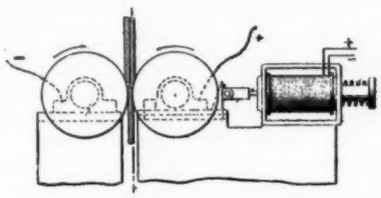
A remarkable series of patents relating to electric welding were issued on January 1 to Thomas E. Murray, Jr., of New York City, partly as sole inventor and partly on inventions made by him jointly with various associates. According to one of these, he forms a cavity on the surface of one of the metal pieces opposite a part of the proposed joint, so that the molten metal flows into this cavity. In another, he welds pipe ends or the like to plates by using a ring-shaped electrode sliding over the pipe and of greater electrical conductivity than the pipe. A third shows a welding machine so arranged as to automatically weld one after another of a series of joints, while a fourth patent applies a current of reduced strength to the metal parts after they are welded together, so as to retard the cooling of the joint and thereby anneal the finished article.



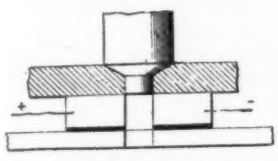
Welding Pipe Ends to Plates.



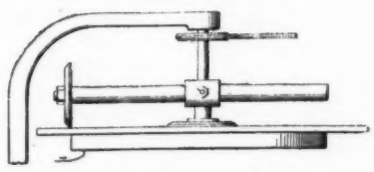
Annealing Electrically Welded Plates.



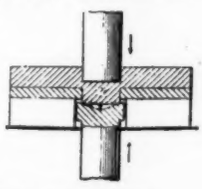
Thinning Lap-Welded Joints.



Countersinking Holes.



Cutting Metal Disks Electrically.



Substitute for Riveting.

For welding plates or bars without leaving protrusions or excessively thick spots, he uses two rollers as electrodes and rotates one of these so as to compress the metal while softened by the heating. To countersink a punched hole, he heats the perforated plate electrically and forces a suitably shaped tool into the opening. To cut metal disks, he uses an electrode arranged like the cutter of a rotary metal shear and moves both this and an adjacent second electrode in a circle over the metal while supplying them with current. Finally, as an ingenious substitute for riveting or spot-welding, he perforates one metal plate, lays the other over this, and forces a projecting part of the latter into the perforation by means of a punch which acts as one electrode in both softening the metal so that it can thus be forced, and in welding the resulting projection to the perforation into which it is forced.

Electric Furnaces to Be Discussed in Chicago.—On the evening of February 25 there will be held a meeting of the Chicago Section, American Institute of Electrical Engineers, at the rooms of the Western Society of Engineers, Chicago. Two papers on electric furnaces will be presented as follows: "Resistance Type Furnace," by Thaddeus Baily, president of the Electric Furnace Company; "Arc Furnaces and Their Application," by John A. Seede, of the General Electric Company. C. W. PenDell, 72 West Adams Street, Chicago, is making arrangements for the meeting.

Proposed Interconnection of Electric Power Supply in Great Britain

Interim Report by Coal Conservation Sub-Committee of the Reconstruction Committee, Ministry of Reconstruction, Dealing With Power Generation and Transmission

DURING the year 1917 a report dealing with the reconstruction of the generation and transmission of electrical energy and the conservation of coal throughout the United Kingdom was submitted to the Right Honorable Viscount Haldane, chairman, Coal Conservation Sub-Committee, being presented under the signature of Charles H. Merz, vice-chairman; William A. Bone, Guy Calthrop, John Kemp, R. A. S. Redmayne and Charles P. Sparks, comprising the Coal Conservation Sub-Committee of the Reconstruction Committee. This report was issued for public information on December 7, 1917, and is here reproduced in abbreviated form.

Importance of Ample Cheap Electrical Energy.

In an industrial country such as England where natural gas, oil and water-power are almost entirely absent dependence necessarily is placed upon coal as a source of energy. The influence of coal cost upon cost of production should therefore be obviously an incentive toward the more economical utilization of coal. The fact that the coal available in the United Kingdom is not unlimited shows the further importance of using coal more economically. Notwithstanding that the average coal consumption per horsepower-hour throughout the country has been halved during the last 25 years the total amount used has increased. A consideration of the probable future development of British industries shows that it is not so much by reducing our total coal consumption as by increasing our individual output for a given coal consumption that progress will be made. Unless this result is attained we shall be faced with the necessity of doubling our coal output or reducing our coal exports to nothing. But the present coal consumption would, if used economically, produce at least three times the present amount of power.

In considering the future it may, we think, be assumed not only that the output of industry will continue to increase, but also, that the use of mechanical power will, even more rapidly, continue to replace, or at least to supplement, human labor. The only way to increase prosperity is to increase the net output per head of the workers employed. It is possible to increase the output per head by harder work on the part of each individual, but there is far greater promise in increasing his output by giving him more machinery to multiply the effectiveness of his efforts. In the United States the amount of power used per worker is 56 per cent more than in the United Kingdom. On the other hand, not only are the standard rates of wages higher in the U. S. A., but living conditions are better. The best cure for low wages is more motive power. Or from the manufacturer's point of view, the only offset against the increasing cost of labor is the more extensive use of motive power. Thus the solution of the workmen's problem, also that of his employer, is the same, namely, the greatest possible use of power.

One question which has been settled conclusively during the past 15 years is that the most economical means of applying power to industry is the electric motor. Thus, the problem is not so much how to apply the power to the tool or process, as the case may be, but how best to generate the electric power. The choice rests between what may be termed the individualistic method or the collective method, the former where each manufacturer generates his own electric energy, the latter where the power plant takes care of the requirements of a large number of individuals, in fact of the community. This latter arrangement enables large plants employing efficient units operating under efficient conditions to be efficiently situated with regard to coal and water, all conducive to highly efficient operation and use of coal with resulting low cost of energy.

Now, it is certain that arrangements ought to be made in the near future for the manufacture in the United Kingdom of many products necessary for the development of the industrial community, which are not now made here and which require large amounts of electric power at very low cost. If an attempt is made to erect electric generating stations for the sole purpose of supplying electrochemical plants for new processes and also for the manufacture of products at present imported, not only shall we not get the cheapest power, but we shall have to use a great deal more coal. If the reorganization of the power supply of the country is dealt with simultaneously we shall free more than sufficient coal for any immediate requirements in the way of new processes. There should be no delay in the erection of such plants, but the sites should be chosen so as to admit of the "super-power stations" which will be necessary to erect, being also suitable for the whole country.

In one or two industrial districts the generation and distribution of electrical power are being developed on correct lines. It is still broadly true to say, however, that, as regards the country as a whole, the requirements of each municipal area, each railway, and each factory are dealt with separately, with the result that the average size of generating machine employed is certainly not more than a tenth—and probably not more than a twentieth—of what it ought to be. Under such conditions economy in coal consumption is impossible. The situation produced has reciprocal and cumulative consequences.

A conspicuous example of the multiplication of individual power plants due to the fact that no large centralized supply is available is that of recent additions to the already generous number of plants in London. The following stations are situated within four or five miles of Hammersmith, and are comparatively recent additions exclusive of some 21 others. With the exception of Lots Road, all these additional stations are badly situated as regards water facilities, and they might all have been advantageously combined on one site with great economy of capital, labor and coal.

	Kilowatts.
London & South Western Railway (Wimbledon)	25,000
Lots Road (Chelsea)	63,000
Central Electric (Grove Road)	22,000
Metropolitan Railway Company (Neasden)	25,000
Metropolitan Electric Supply Company (Willesden)	21,250
London & North Western Railway (Stonebridge Park)	25,000
Central London Railway (Wood Lane)	7,500
Great Western Railway (Park Royal)	6,000

The position of large local authority undertakings in the Midlands is most unsatisfactory. Their power-station sites have been primarily selected from the point of view of retaining the works within the city areas, so that the "rates" on such works may be retained by the operating local authority. None of the undertakings of Birmingham, Liverpool, Manchester or Sheffield have sites with proper water and condensing facilities. The whole of these undertakings use cooling towers. These undertakings generated during the last 12 months between 600 and 700 million units. While the present position is most unsatisfactory, the future expansion of these undertakings gives rise to still greater apprehension. Important extensions on new sites are already projected, the additional plant proposed aggregating some 300,000 kilowatts to 400,000 kilowatts. In the case of Birmingham, the new site chosen is within the city boundary, and the condensing facilities are limited to cooling towers, and owing to shortage of water supply raw sewage effluent will have to be used for "make up" purposes. In the case of Sheffield, the new site, which is the subject of a Parliamentary inquiry, adjoins the city boundary, and cooling towers for dealing with a 50,000-kilowatt demand will have to be used a large part of the year.

Remedying an Unfortunate Situation.

The use of electric power, generated in central stations, for all classes of work would show a considerable increase with the decreasing cost of electricity so generated. The effect is cumulative; an increasing coal economy, implying a correspondingly decreased selling price of electric power, increases the load on the large power plant, while increased consumption of electricity and improved load-factor produce in their turn a further economy of coal consumption by improving the condition of load. In fact, the only way in which public supply stations can secure the business of supplying all the power users in a given area is to have generating machines much larger than the largest individual manufacturer could find use for. If power is to be supplied throughout the country at the lowest possible price, the following conditions must be secured:

1. The power users in each industrial district must be supplied from one common interconnected electrical power system.

2. Large generating machines, not less than 20,000 horsepower, must be used, and they must be erected in the best possible positions for economical production. In the more important industrial districts generating machines of 50,000 horsepower might be advantageously used.

3. Power available from surplus gas or waste heat should be turned into electrical energy on the spot in local plants which would feed into the main distribution system. N. B.—As regards waste coal, this could, where transport was the ruling consideration, also be used on the spot.

On account of the compact nature of the country such a system is commercially practicable and advantageous here to a greater extent than it would be in other countries, but just as trade between different parts of the country would be impossible, or practically impossible, without railways, so trade in power—that is the supply of power where most required from the source where it can be most economically generated—is impossible without trunk mains. Such trunk mains or electrical "roads" must be standardized.

There are important additional advantages to be secured from the erection of plants on roomy and efficient sites rather than on crowded and inefficient sites, apart altogether from those resulting from the increase in the size of the plant:

1. Centralization of production materially facilitates supervision and insures the better operation of any given plant as regards improvement in general coal economy.

2. The health of the great industrial centers and the congestion of the railway lines in their neighborhood would be radically improved by arranging for the conversion of coal into motive power to be carried out away from the densely populated centers.

3. By locating either the main or supplementary plants at or near the collieries much coal that is now wasted or left in the pits could be profitably utilized, and the coal which would otherwise be burned to transport the coal used would also be saved.

4. By-products obtainable from the coal before it is consumed in the boiler furnace, or producer, could be extracted in any case where it was proved to be economical to do so. These by-products may be of as great value to the country as the fuel residuum, for nitrogenous fertilizers, crude oils, oils for marine propulsion, and motor spirit for road traction, can all be largely extracted from coal.

Apart from the saving in fuel, centralized power production is essential if the capital charges and labor costs are to be reduced to a minimum. This, as we have seen, arises from the fact that it is only by supplying all the needs of the community from one system that the maximum use can be made of the plant. As a great many individuals in a given community do the same thing at the same time, what we must take advantage of is that the individual cannot do half-a-dozen things at once. The economy of a combination of all requirements, power, traction, lighting and heating, is fundamental.

At the present time the supply of electricity in Great Britain is divided between some 600 company and municipal undertakings. The average capacity of the power stations is only 5000 horsepower.

The multiplicity of London's central electricity supply, and small individual capacity of the stations is shown in the accompanying table:

London Electricity Supply.

Positions in 1913.*

	Central Area.	Greater London.
Number of authorities	39	70
Number of generating stations†	41	70
Average size of stations	7646 kilowatts	5285 kilowatts
Average size of units	787 "	632 "
Number of types or systems of generation	31	49
Number of frequencies	8	10
Number of voltages—generation	20	32
Number of voltages—distribution	21	24
Number of methods of charging and prices	50	70

*The status has changed somewhat since the above table was prepared in 1913 for the London County Council.

†In addition there are nine traction stations within the Greater London area, eight of which are within the Central Area.

It is not suggested that a scheme of power distribution for the whole country can be treated as an ordinary engineering project and commenced "de novo," but it is urged that the time has now arrived for the matter to be considered comprehensively and for the reorganization of the existing indiscriminate power supply systems to be undertaken on correct lines. To utilize plant existing at the present day to the best advantage is by no means an easy problem. The main transmission system must be alternating current three-phase at high voltage—no engineer would dispute it—but a more difficult question is that of frequency; in Great Britain no less than 10 frequencies are employed today. The chief difficulties are, however, not technical ones, but what may be called political.

In order to illustrate the inefficiency of the present system of dividing up the supply of electricity into a number of small undertakings, in most cases the property of a municipal authority and confined to a municipal area, a list of the average prices received for current by a number of representative municipal undertakings in the Lancashire industrial district is given and compared with the average price paid by consumers on the Northeast Coast. The Lancashire group has been taken because it is a very favorable example of an industrial area where coal is cheap and the load good, namely, compact and large, and where conditions are conducive to cheap energy supply. The price paid for energy throughout the Northeast Coast averages less than ½ pence per unit (equivalent to about 1 cent, American money), while the use of energy per head relative to population is three times as great as that throughout the industrial area referred to in the accompanying table:

AVERAGE PRICES CHARGED CONSUMERS BY ELECTRICITY UNDERTAKINGS IN THE LANCASHIRE AREA, IN PENCE PER UNIT.

	Private Supply.	Public Lighting.	Traction Supply.	Total Supply.
Liverpool Corporation	1.82	1.88	1.13	1.50
Manchester Corporation....	1.02	2.11	1.03	1.02
Eccles Corporation	2.17	2.18	1.13	1.71
Salford Corporation	1.31	1.35	1.27	1.29
Stretford Corporation	2.27	1.14	1.13	1.49
Stockport Corporation	0.90	0.50	0.55*	0.80
Bolton Corporation.....	1.03	....	1.10	1.05
Bury Corporation	0.67	2.24	1.08	0.72
Heywood Corporation	1.30	3.00	1.25	1.29
Leigh Corporation	1.65	....	....	1.65
Rochdale Corporation	1.33	....	1.01	1.20
Wigan Corporation	1.50	2.26	1.19	1.38
Ashton Corporation	0.72	1.37	1.22	0.85
Oldham Corporation	1.42	1.99	1.50	1.44
Stalybridge Joint Board....	0.67	1.10	0.50	0.66
Accrington Corporation	1.12	2.59	1.75	1.15
Blackburn Corporation	1.63	1.95	1.39	1.58
Burnley Corporation	2.00	1.11	1.18	1.49
Colne Corporation	2.25	1.00	1.63	2.00
Darwen Corporation	1.22	3.17	1.27	1.29
Nelson Corporation	2.68	....	2.00	2.42
Rawtenstall Corporation ...	1.16	2.69	1.23	1.03
Middleton Corporation	1.31	4.35	1.32	1.32

*Does not include any capital charges.

Note:—Multiply by 2 to obtain roughly equivalent in cents, United States money.

IMPORTANCE OF INTERCONNECTION.

While it might be feasible for local concerns, whether municipal or company, to retain, as separate bodies, the ownership of mains and the business of supplying lighting and small power consumers, the generation and main transmission and distribution of electrical energy and the business of supplying power to manufacturers, railways and other large users, must, in each district, be in the hands of one organization.

The proposal to link up adjacent power stations is a step in the direction of greater economy and should be encouraged, provided it is appreciated that it is only a step. As a permanent solution it is not effective, for, first, it is impossible to run a large number of linked-up stations at the highest economy unless they are under the same ownership and control, and, secondly—and more important—where such stations are under separate control a linking-up scheme, pure and simple, tends rather to perpetuate the uneconomical station than the reverse. To regard a scheme of linking up between existing concerns as a permanent solution is hopeless.

It has been frequently proposed as an alternative to mere linking up that bodies should be created which would deal solely with bulk supply, existing authorities being compelled to take all further electrical energy beyond what they can generate in their present stations from the new bulk supply system, and being allowed to run their existing stations as far as they desire to do so for a period of years. The disadvantages are:

1. That it would take much longer to make a change over to economical generation on account of the tendency of the existing bodies to wish to keep their own plants.

2. That the delay in the transfer of the load would prevent the greatest economies being effected on account of the less load the new stations would have to deal with.

3. That when the transfer was complete, as in time it would be, because of the lower cost of the new system of generation, the existing bodies would be left with indifferent obsolete plants.

4. If the existing stations were owned or operated by different bodies they would not be of much use for stand-by and peak-load purposes, as they might otherwise be.

On the other hand, wherever there is unity of ownership and control not only are all the advantages of linking up secured but the erection on correct lines of all further generating plant required is assured. If single ownership and control are once secured for a district there is no political or other reason why all plant should not be of the most economical type and size, and installed on the best possible sites; the individualistic system of a separate station for each municipal area will be abandoned, and centralization of production by means of the largest possible prime movers will be secured.

If such a system were inaugurated it may be confidently stated that on the basis of the extent to which power is used at present a saving of 55,000,000 tons of coal per annum can be expected. Taking the value of this coal for export at 10 shillings per ton, the national annual advantage of the change, available for interest on capital, is, say, £27,500,000 in coal alone. Conversely, if this 15,000,000 tons of coal were used for extended and new industrial processes, some 15,000,000 horsepower continuously would be available throughout the year. In addition to the above saving, namely, £27,500,000, there is also a saving due to the reduction of coal transportation, reduced coal handling involved from house-to-house delivery and general distribution, reduction of the 35,000,000 tons annual domestic coal consumption, the more extended use of electricity for heating, cooking, cleaning and labor-saving purposes, smoke reduction, possibility of by-product extraction before burning the coal, electrification of railways, which together can hardly be put at less than £100,000,000 annually, apart from the manu-

facturing and industrial advantages of cheap and efficient electric power supply.

Legislature Required to Deal with the Situation.

As already pointed out, if a comprehensive system of electricity supply capable of not only dealing with the supply for new processes and products but also of economizing coal consumption for existing purposes is to mature it will be necessary, firstly, to establish in each industrial district and neighborhood one electricity body owning and operating the electricity supply system and, secondly, to use generating units of large size in plants situated advantageously. Notwithstanding the "Power Act," the purpose of which was to encourage energy generation and distribution on a large scale, development along correct lines has largely failed to materialize; and rather than assist the power companies to obtain the comparatively small lighting and power authorities it has enabled the latter to interfere with the proper and efficient development of the former.

In order to secure, even on existing lines of development, the more correct extension of electricity undertakings as the demand grows, it has been proposed to appoint electricity commissioners. While this step is certainly desirable, and nothing should be done in any way to delay its being taken, it is considered that this proposal does not go far enough.

Your sub-committee has carefully reviewed the above consideration, and in framing its recommendations it has had before it that:

(a) This question has been prominently before Parliament for different districts on numerous occasions and no solution has been arrived at.

(b) Consequently, with one or two exceptions, there are practically no modern electric power generating plants in the country.

Existing generating plants are uneconomical and ought to be scrapped, but this cannot be done until more modern plants are made available. If, however, such plants were established and running, and it were, therefore, possible to recommend existing authorities to connect up to these big plants, and they were sure of being able to get power at short notice if they did so connect up, the position would solve itself on purely economic lines.

Recommendations.

1. It is essential that the present inefficient system of over 600 districts should be superseded by a comprehensive system in which Great Britain is divided into some 16 districts, in each of which there should be one authority dealing with all the generation and main distribution.

2. Centers, or sites, suitable for electric generating purposes should at once be chosen on important waterways as the future main centers of supply for each of the districts into which the country is to be divided.

3. The sites so chosen should be as large as possible, having in view the land available in suitable localities, and should have ample water and transport facilities. Land is required not only for the power stations themselves—which for the sake of security and safety would have to be suitably subdivided, that is, they would not be contained all in one building—but for the processes involved in the extraction of by-products from the coal before it is used for the production of power, where such extraction is found to be justified. It is also required for the development of electrochemical processes, which may be most conveniently carried on in close proximity to the power plant. This condition entails the sites being chosen outside, not inside, towns.

4. Plans should be prepared for the construction immediately after the war on these sites of the first instalment of large super-power plants capable, first, of supplying, through a comprehensive electric power distribution system which must be also arranged for, the existing demands of the community; and, secondly, of supplying electrical energy at the lowest possible price for new processes and manufactures.

5. Such plants would be designed so that, as methods are perfected for extracting by-products from the fuel, before using it for the purpose of the production of electric power, the by-product plant can be combined with the power plant. Each site should be laid out with this view, and with a view to the unrestricted extensions of the plant as required.

6. Power available from surplus gas or waste heat should be turned into electrical energy on the spot in local plants which would feed into the main distribution system. As regards waste coal—i. e., coal which it does not at present pay to bring to the surface—this could, where transport was the ruling consideration, also be used on the spot.

7. Once these plants are in existence it would be possible for existing authorities, without any risk of being left in the lurch, to stop extensions of their own uneconomical stations, mostly on cramped and unsuitable sites, and to arrange to take their power from the main system.

8. With a view to carrying out the policy advocated a Board of Electricity Commissioners should be appointed, with full powers to deal with the electricity supply situation throughout the country. They should have power—*inter alia*—

(a) To stop the extension or multiplication of uneconomical stations for public supply.

(b) To arrange for the handing over, on equitable terms, of the generation, transmission and main distribution system in each of the areas into which the country is to be divided, to a new electricity body.

(c) To standardize for each area the frequency and voltage of the main transmission and distribution system.

(d) To settle for each area whether such body should consist of a Parliamentary company working under adequate control as regards limitation of dividends, etc., or one of the other alternatives.

9. Alternative types of the new electric power organizations are described in an appendix. In reference to these alternative types the subcommittee is impressed with the special need for initiative and resource in the management of the business of power supply, and it is of the opinion that the freedom of range and keenness which are distinctive of private enterprise will be found in a high degree conducive to the fullest measure of success. The subcommittee considers that if the nation is to get immediately an efficient power supply, and is to take advantage of the temporary lull in manufacturing output immediately after the war, State assistance in some form may be necessary.

The report contains at the end five appendices, the first four dealing respectively with the consumption of coal per horsepower-hour in the United Kingdom and fuel economy as a result of the organization of power production and distribution; electricity supply legislation; alternative types of electric power organizations; fuel economy on the North-East Coast as a result of electric power supply.

Low-Temperature Industrial Heating

Second Part of Paper on Electric Heat Presented at Dayton Meeting of Ohio New-Business Men—Operation, Control and Advantages—How to Secure the Business

By DWIGHT D. MILLER

THERE are two different ways of producing heat from electrical energy. These are (1) by means of resistance, (2) by means of an arc. It is readily seen that heat can be produced for use by either of these methods from both direct as well as alternating current, single or polyphase, and at any voltage. Hence, practically all of the heating devices at present on the market can be operated from any available source of current.

Of these two methods, that of producing heat by means of resistance, aptly termed the "Joulean effect" since it is based on Joule's law, is almost universally employed; about the only exception is that of the use of the arc in arc welding.

Moreover, due to prevalance of alternating-current supply throughout the country as well as its greater flexibility and efficiency when used over the wide range of voltage required by the various processes of application, alternating current is used in the great majority of cases. The use of the transformer with its many available taps makes possible the attainment of varying temperatures with an ease and efficiency that can not be approached by the use of direct current. Moreover, the heating unit load is practically non-inductive and can be used in polyphase as well as single-phase circuits, so that the use of alternating current for this work gives a unity power-factor in almost every case, and possesses many advantages over direct current.

For instance, in order to obtain the very low voltage used in spot welding from a direct-current supply, it would be necessary to employ a rheostat in connection with a specially wound low-voltage generator with the attendant large losses, while by the use of alternating current these voltages are readily obtained from practically any commercial supply circuit by means of the transformer.

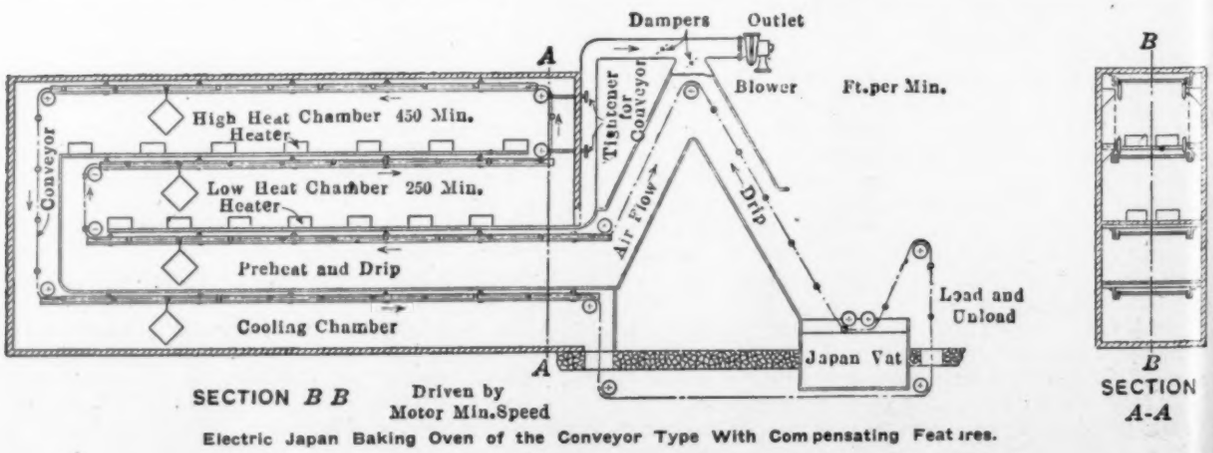
Control of Electric Heat.

One of the many reasons for the use of electric heat is that it is susceptible of perfect and automatic control, both as to localization, time and temperature, to an extent of nicety impossible with any method of combustion. This is true whether the control be by hand or automatic, although automatic control permits of greater delicacy and refinement than does hand control.

Varying heats, high, low and intermediate, are obtained with hand control by switching devices which connect the heating units or groups of units in series, in parallel, or in series-parallel if direct current is used, much in the same manner as a four-motor street-railway equipment is handled, while, if an alternating current is used, this same effect is obtained by use of the delta-Y connection with constant voltage on the supply.

These different heats occur in certain well defined and distinct steps according to the wattage produced by the various connections and grouping of the heating units, although gradations between these steps can be obtained by means of a rheostat in the case of direct-current supply, and by varying the voltage on the secondary side of the transformer when alternating current is used.

In carrying on the various processes of industrial heating there is always a certain definite temperature which will produce the best results in the shortest time, and which is best suited to any particular phase of the process, and it is the ability of electrically controlled units to not only meet and maintain this specific temperature to a nicety but also to vary within a fraction of a degree with the temperature requirements of the various phases of the process, that makes the control stand out as far superior to that employed by any method of combustion heating devices. This close regulation is of the utmost importance in some applications where a variation of even one degree may spoil the work of many weeks. For instance, in the cultivation of bacterial cultures, as done in the Rockefeller Institute incubator rooms, temperature is maintained constant within one-half degree. In the baking of enamels in an oven, a variation of only 15 degrees



Electric Japan Baking Oven of the Conveyor Type With Compensating Features.

may change the color. These varying and fine gradations of temperature are best met by automatic control.

The essential features of automatic control are a thermostat, which by definition is an automatic apparatus for indicating or regulating temperature, a current relay, a solenoid switch, and contactors. There are a number of different types on the market designed for use with various temperatures. For temperatures below 1000 degrees Fahrenheit the mercury-actuated and the expansion types are used, while for higher temperatures a thermoelectric pyrometer is generally used in industrial heating processes.

Interior of Electric Japanning Oven.

The Tycos electric contact type of thermostat is in general use by one of the largest electric manufacturing companies for temperatures up to 1000 degrees Fahrenheit.

For temperatures from 350 to 550 degrees, inclusive, the actuating or sensitive member is of the vapor-tension type (expansion principle) because of its greater sensitiveness and quick response to change of temperature. This characteristic is of the utmost importance because on some work the temperature used is very near the maximum which the work can stand and, if there is any time lag or sluggishness in the instrument, the maximum temperature may be reached while the instrument is actually indicating a temperature considerably below this.

For all other temperatures up to 1000 degrees Fahrenheit the sensitive member is of the mercury-actuated type.

Time switches are also employed to great advantage in connection with automatic control. By means of this device it is possible to start up or shut down the heating operation at any time of day or night desired, thus saving much time and labor. The switch may be set to start heating, say, at half past six in the morning so that when the operator arrives at seven o'clock no time is lost in bringing the apparatus up to proper temperature, and the work of the day can be started at once. Again, in the operation of baking, the bake may not be fully completed at quitting time. In this case, the switch can be set to disconnect the oven at the proper time, after operator leaves, at which the bake will be completed.

A very striking example of the flexibility and ease of control in the application of electric heat is found in the electric welder. Here the heat is generated at the exact spot and to the exact degree to effect a perfect junction of the metal without the use of any flux whatever. Where can you find a fuel-fired process so simple, so complete, so efficient in utilization of heat?

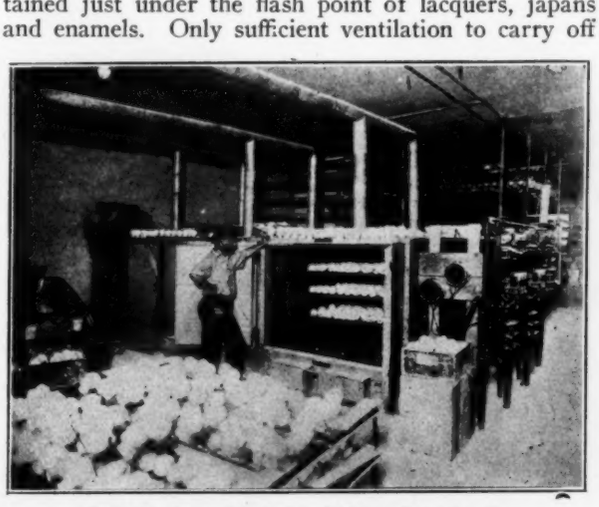
Advantages of Electric Heat.

From what has gone before it must be apparent that the advantages to be obtained from the heat of electrical energy are many and great, both as regards thermal efficiency as well as increased production and better quality of product. Enumerating them briefly, these include saving in time, labor and space, with the attendant saving in first cost of apparatus, overhead, real estate and taxes included by them; greater thermal efficiency in that electrical energy is transformed into heat at 100 per cent efficiency and is utilized at from three and one-half to four times the efficiency of fuel-combustion devices.

It is clean, safe, sanitary. It can be used in any atmosphere and generated in any quantity or at any temperature desired. By its use the fire hazard is greatly reduced and the working conditions of labor vastly improved. It is susceptible of perfect and automatic control as regards localization, time and temperature to an extent not yet attained with any other method and exact conditions can be duplicated at will.

The heating unit is small, compact and substantially built, which allows of greater flexibility in application than with any other heating device. When applied to various industries or processes of those industries each unit has its own specific advantage. We have already seen the advantages to be obtained from the electric furnace.

In drying and baking of all kinds, by the proper control of temperature, drying can be accomplished under 212 degrees Fahrenheit, so that the moisture is not too rapidly converted into steam, thereby requiring additional ventilation. Heat can be more uniformly distributed and controlled so nicely that it can be maintained just under the flash point of lacquers, japans and enamels. Only sufficient ventilation to carry off the vapors arising from the process is necessary, while in some phases of it the vents can be entirely closed and all the heat conserved.



Electric Oven Used for Baking Doll Heads.

In spot and arc welding intense heat in the desired quantity can be concentrated at the exact place and for the time required only.

In riveting and upsetting no unnecessary or overheating occurs. Low-voltage current is passed through an inch or two of the bolt or rivet blank, raising its temperature so that the head may be formed in the bull dozer, the remainder of the blank remaining so cold that it can be held in the hand.

In the heat treatment of steel, scale is done away with, the work is not burned or heat-treated to such

an extent as to make it worthless. Control of temperature is here essential and can be obtained to a nicety in the annealing furnace, and the percentage recovery of the metal greatly increased.

In heating of liquids, melting of metal in pots and hot-plate work, the units are so shaped and imbedded in the apparatus used and of such thermal characteristics as to accomplish the work with the least possible expenditure of time and energy and at the highest efficiency.

Summing up, the advantages to be gained by the use of the heat of electric energy are:

1. Saving in time, labor and space, with the attendant saving in overhead, real estate and taxes.
2. Can be utilized in any atmosphere, resulting in vastly improved conditions of labor.
3. It is clean, sanitary and safe, resulting in reduction of fire hazard and risk of loss of material, product and even life itself.
4. Greater thermal efficiency, since heat is produced without loss and utilized at from three and one-half to four times the efficiency of fuel-combustion devices.
5. It can be controlled automatically to an extent impossible by any other method of producing heat.
6. Can be generated in any quantity and at any temperature required in the industrial heating field.
7. It can be concentrated at any desired point and confined to definite area.
8. It is more flexible and can be readily applied to a large variety of uses.
9. By its use greater product for a given time is obtained and its quality improved.
10. Specific conditions can be duplicated at will, since with size and material of conductor as well as impressed voltage for a given installation once fixed, the same amount of current will flow automatically, producing thereby the same amount of heat.

Points to Bear in Mind in Acquiring the Heating Load.

The load secured from the application of electric heat is an ideal one, huge in quantity, yet in general composed of a large number of small installations with a high and practically noninductive load-factor, of just the right characteristics to straighten out the prevailing fluctuations in power demand and help equalize the output of the station over the entire 24 hours.

To obtain this load in a manner satisfactory to both the central station and the consumer, it is essential that the salesman be conversant with not only the thermal characteristics of the various heating units, with the manner of their application and method of operation, but also with the details of the requirements of the various processes in which they are to be used. Too much emphasis cannot be laid on this point. The same broad considerations that led to the adoption of gas fuel in place of coal or coke-fired heating devices has forced, and is influencing every day, the adoption of electric heat in place of gas or oil-fired apparatus in spite of the fact that, viewed from the standpoint of heat energy only, either is cheaper in almost every instance.

The crux of the whole matter lies in the fact that the cost of heat energy alone as compared with the cost of the entire finished product is in many instances negligible. Many items enter into the total cost of production, of which heat energy is only one, so that while electric heat may be the more expensive still, if by its use the other items (such as time required, labor, fire insurance, etc.) are cut in greater proportion, producing greater quantity as well as improved quality, it is evident that not only is electrically generated heat cheaper to use but also its use is imperative in order to compete successfully with those using it in similar processes.

It is a mistake to try to use electric heat in all industrial heating applications because by the very nature of the intermittent methods and inefficient use of heat of many processes in their present form, the energy charge, which in this case is a major charge, would be prohibitive. There are some exceptional cases where it is advisable to use electrical energy even though its cost is several times greater, as, for instance, the replacing of gasoline-fired linotype pots with the consequent dirt, smudge and great fire hazard, all of which are present to a much greater extent than in the case of gas-heated pots.

Large business today is keenly interested in and has to a great extent adopted the principles of scientific management. This is nothing more than the intensive study by trained men of each and every operation, process and method used throughout the entire organization, and their reduction to the most elemental form possible; the analyzing of these forms and the installation of new and improved methods, where necessary, resulting in the greatest production and of the quality desired with the least expenditure of time and energy. When manufacturing in quantity, there is always *one* best way to perform the various processes through which the work must pass to its completion. Scientific management determines this particular way and standardizes it with the result that what has been termed as the continuous method of production, resulting in large volume at low cost, has of necessity come into use. Its advantages are many and obvious. To this phase of manufacturing electrical energy is peculiarly adapted and by its use the process most easily changed over from the intermittent to the continuous method. Unless such a change can be effected, in many instances electrification will be a failure.

Illustration of the Advantages of the Continuous Process Made Possible by Electric Heat.

In order to illustrate the many advantages of the continuous over the intermittent process, a good example is that of the customary practice in japanning rooms. Work is dipped by hand, often only one piece at a time, and then hung up by hand to drip. Next it is carried, again by hand, into an oven which may or may not be partially heated, and hung on supports to be dried and baked. As soon as the oven is completely loaded in this manner, it is closed and the heat turned on, being brought up to the temperature required, which is maintained until the bake is completed. The heat is then turned off, and the oven allowed to cool sufficiently to allow men to enter and carry out the material piece by piece.

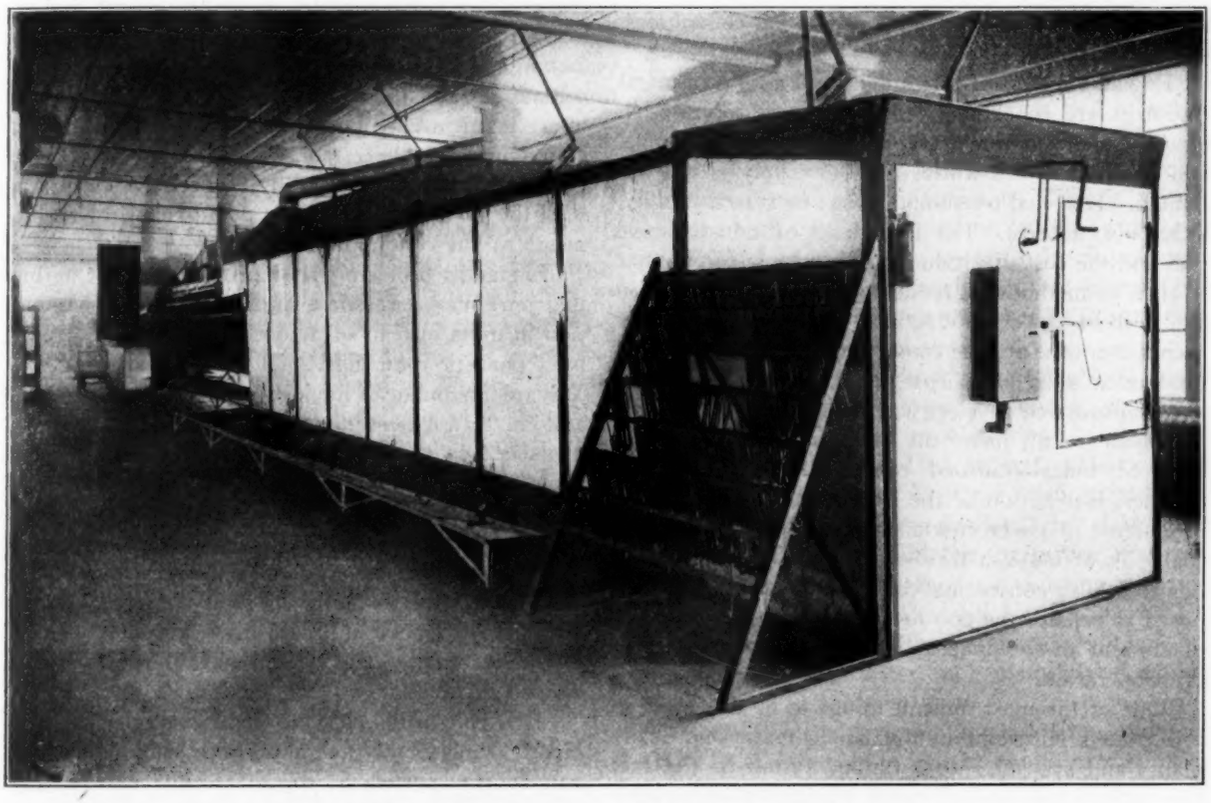
Such a process is obviously most inefficient, its shortcomings many and expensive, but typical of the intermittent methods as used in thermal processes. An analysis easily demonstrates these.

Human beings, which are the most expensive of all laboring devices, are used for handling the work and only a small part of it at a time. Due to this method, the dipping, dripping, and oven equipments are in active use but a fraction of the possible productive working time. A large amount of heat energy is wasted and time lost since after the oven is heated to maximum temperature it is allowed to cool off, only to be heated up again for the next bake, while as much

or even more time is spent in cooling as in heating up, and that lost during the loading and unloading is large.

On the other hand, the continuous process produces exactly opposite conditions and makes use of mechanical devices as much as possible. The work is dipped all at once after being loaded on a conveyor which also carries it over the drip tanks, also through the oven and places it in readiness for the next operation. The salient features here are that the work is handled in quantity by mechanical means and no time wasted in heating up and cooling off the oven, since the men do not have to enter it. The chain conveyor system is now mostly used.

It is evident that by the use of such a process the first cost of equipment required is reduced to a minimum since all parts of such an installation can be used continuously. It is also obvious that the cost of labor required in this process as compared to the intermittent process as described above is likewise reduced to a minimum.



View of Electric Enameling Oven at Ford Assembly Plant, Chicago, Ill.

Other advantages, which at first thought are not so apparent, have been so well described by Prof. C. F. Hirshfeld in his article, "Continuous Methods in Thermal Process," that we quote from it as follows:

"First, all items connected with the process, such as position of work during dip and drip, time of drip, time to bake, etc., may be definitely set and duplicated time after time without variation, by proper design and proper choice of conveyor speed. All these items are therefore made independent of the foibles, "hunches," and negligence of human attendants.

"Second, the oven can be easily so arranged that the work is passed through zones of properly graduated and properly maintained temperatures so that it may be heated and cooled exactly in those ways which have been found by experiment to give the best results. Again the human factor with all of the inherent chances for error is eliminated, and if one piece of work is good, all must be good.

"Third, the ventilation of the oven need not be varied from time to time, as in the case previously described. The japanning process is continuous, and ventilation can be continuous. The ventilation can therefore be set at the value found best by experience and maintained at that value indefinitely. Another variable is thus eliminated.

"Fourth, by passing the ventilating air and the work in opposite directions, the thermal advantages of counterflow can be obtained. The outgoing work can be made to heat the incoming air to a certain extent, thus reducing the quantity of energy used for this purpose in the heating zone itself; and the outgoing air can be made to preheat the incoming work, thus reducing the quantity of heat which must be given to the work in the heating zone of the oven. With properly proportioned apparatus it is conceivable that the ventilating air might be passed through the oven without removing any heat therefrom and that the passage of the ventilating air might actually reduce the quantity of energy required for heating the work itself. Great energy savings are possible, even if this ideal is not commercially attainable.

"Summarizing the comparison between the intermittent and the continuous methods of japanning, it may be said that the former is costly, haphazard and unsatisfactory, while the latter is cheap, scientifically accurate and highly satisfactory."

The Minneapolis (Minn.) General Electric Company is conducting a direct-by-mail campaign to owners of unwired dwellings on its lines with good results.

Editorial Comment

Interconnection of Power Systems

ELSEWHERE in this issue will be found in condensed form the interim report of the coal conservation sub-committee of the reconstruction committee formed to investigate and report on power conditions and tentative remedies in Great Britain. This report contains much of interest to us, for the situation here is very similar to that in England, the difference being one chiefly of degree. For this reason the report is respectfully recommended to our fuel administrators and coal conservation committees, since the remedy in both cases is basically the same.

England is less fortunate than we so far as natural resources are concerned. She has practically no oil, natural gas nor water power. Of coal she has ample, and the best in the world, but the supply is not unlimited. Her coal consumption has increased rapidly, as has also the cost. The dependence of industry upon coal and the cost of production likewise is forcing her to turn to methods of reducing the coal consumption and cost of power production. Electrification offers such a means of at once conserving coal and increasing production at reduced cost. Put tersely, generation and transmission of electrical energy upon a gigantic and efficient scale offers the solution of the vital problems of today—railroad relief, alleviation of coal famines, elimination of the smoke nuisance, increased production at lower cost and general conservation of coal. To accomplish these things, obtain ample cheap power whilst conserving coal and capital, it is proposed to replace the 600 or more plants by 16 superplants and all so connected together as to enable efficient operation.

One of the most difficult things to be overcome in the United Kingdom in the amalgamation of many plants and systems into a unified system is the fact that many frequencies, much antiquated equipment and different privately-owned and municipally-operated plants will have to be either absorbed or abandoned. These many small plants have sprung up partly on account of the laws of the country, but more because each community has grown up individually instead of growing up together. Municipalities have built their plants so as to come within their own municipalities, without regard to suitability. Another reason partly responsible for the number of small stations located in fairly close proximity of one another has been that artificial cooling of condenser water has been necessary, usually by towers, generally expensive and rarely efficient, and a practice of increasing difficulty with the larger stations. The demands for energy had not been co-ordinated and the requirements for power and lighting locally have been met locally and individually where in many cases unification would have been preferable in every way.

If the recommendations of the sub-committee on coal conservation are followed, the 600 odd plants in the United Kingdom will be eventually replaced by some 16 super-stations suitably situated and interconnected together. Industrial plants having available waste heat, it is intended, shall be used according to the amount of waste heat available. Whatever conflict there may be between the interests of the local electrical authorities which exist at present and the interests of a comprehensive scheme, there is no conflict in this matter between the interests of the local community and those of the nation as a whole. The interests of every individual user of electricity are bound up with the establishment of a system which will deal comprehensively and upon the right lines with the gradual development of all electrical requirements of the community.

England's problem is our problem, except perhaps that ours may necessitate interconnection and unification in units instead of as one unit. In any case, the interconnection of individual units must come first. We are fortunate in having water power, natural gas and oil to augment our coal supplies. England has awakened to the fact her coal supplies are not inexhaustible, and thus is determined to abandon the extravagance of the past. When the lull comes after the cessation of hostilities, the United Kingdom hopes to turn toward efficient economical electrification upon a vast scale. By so doing she will conserve her coal, alleviate the smoke nuisance, make available plenty of low-priced energy, and revolutionize the railroads. We can do no better.

It is recognized that electrical energy is more efficiently, conveniently and cheaply transmitted than coal can be transported, at the same time extending the capacity of the railroads accordingly. It is thought that with the coming of interconnected transmission lines and bulk generation of energy, so, too, will come the electrification of railroads in due course. We know our railroads are overloaded with freight, that the transport of coal constitutes 38 per cent or more of total freight hauled by the railroads. It is difficult to estimate the vast saving in cost and also increased capacity if energy were transmitted instead of transported as coal.

We here fully understand the importance of large units installed in stations of 100 or more megawatts located upon suitable sites, and operating at high load-factors. We also are beginning to tie-in systems and stations and thus obtain the economies of equipment and fuel that obtain by so doing. Samuel Insull, one

of our foremost public utility operators, has long been an advocate of interconnection of power systems.

Germany and Austria are linking up their tranmission lines and generating stations. England has taken her energy and fuel problem in hand seriously and may be expected to prosecute it to a successful conclusion. Surely we cannot stay aloof by not doing the same. With our vast natural resources, with our favorable position, and with the radical strides already made, surely we will harness the water powers, link up the coal mines with industry by wire instead of congested railroad tracks and interconnect generating stations and transmission systems for economy of investment and energy production and distribution. Electrification means not coal saving alone. It means increased production and lower cost, a very important factor if we are to go out to conquer world markets with the existing labor situation. It means labor and equipment may be better utilized. It means economy and thrift instead of waste of material and effort and health.

The Trend of Coal Prices Encourages Pulverized Coal Development

While the use of pulverized coal has long been employed in certain industries, the coal situation of the last year or so has brought it to the front as a possible if not probable solution to the low-grade fuel problem. Necessity has created a demand for the poorer grades of coal, and they have been used, and in use have caused considerable trouble in many ways. Many there are who look to pulverized fuel for overcoming the smoke and clinker troubles, and making available coals that otherwise could not be generally used.

In the cement industry pulverized coal has been used for some twenty years, and the metallurgical industries have more lately taken it up. The railroads, looking for higher efficiency, greater ease and closer accuracy of control, the elimination of cinder, smoke and sparks, have welcomed pulverized fuel and recognize its latent possibilities. Pulverized coal has been used of late to a larger if small extent under stationary steam-making boilers, but only upon a small scale. The results are what might theoretically be expected, yet the large amount of auxiliary apparatus required for crushing, drying, pulverizing and feeding of coal and air have acted as deterrents toward its wider adoption. Many problems in placing pulverized coal upon a commercial or industrial basis have already been solved, but many remain. Some are concerned with the treatment and use of coal; others concern the furnace chamber and the effect of erosion, freezing slag and result from the high velocity of the furnace gases, their high temperature and behavior of pulverized ash.

In all walks of life, in every branch of industry, efficiency and economy are being striven after tirelessly. Conservation of coal and water, of time and money and labor, and the high cost of coal have never before approached the magnitude they have attained today. Accurate control of heat, efficient utilization of coal, increased steam-making capacity, and lower cost of operation, are the things that are helping to break down the proverbial conservatism borne of old-time methods and hold promise of enabling pulverized coal to be developed upon a large scale, with results perhaps not even possible in the small plant.

Power Development a National Problem

INDIFFERENCE and opposition to national legislation designed to facilitate the development of water power on the public domain have been due, in some degree, to the fact that this proposition is interpreted as being one that principally concerns the Rocky Mountain and Pacific Coast states, in which there exist extensive forest reserves and other lands controlled by the Federal Government. Those lands, reserved and otherwise unoccupied, mostly cover the headwaters and upper reaches of streams in mountainous and semi-arid regions, where water-power possibilities exist. In the states of the East and Middle West the title to nearly all the original public domain has long since passed either to private ownership or to the individual states.

The state of New York, for instance, is awaking to the necessity of developing the unused water power of its streams, but the problem there is a matter of state legislation, instead of federal. That state has its Adirondack Forest Preserve, rich in streams of tremendous power resources; and the state government has taken the initiative to utilize that power without despoiling the scenery or violating the original purpose for which the Preserve was set apart. Dams and hydroelectric plants in that domain will not vitiate nor consume the water, nor disturb the mountain trout.

Similarly, the streams flowing from the watersheds of the western mountain ranges may be utilized for power purposes without violating any of the principles of true conservation. Those domains, now under federal control, may remain so indefinitely, but that should not be allowed to stand as a bar to legitimate power development on the streams within their borders. The open sesame to this result is congressional enactments which conserve and protect, but which will encourage the use of this latent power.

Every hydroelectric plant in service means the conservation of coal and oil supplies. The electrification of thousands of miles of transportation lines within the radius of possible hydroelectric development is a possibility which would have a telling effect in reducing fuel consumption. The nation as a whole should be concerned with the problem of hydroelectric development in the West, or in any other group of states having water-power resources.

Week's Events

Lynn Section Discusses Metric System—Rate Problems—"Daylight Saving" Plan—A. I. E. E. Program—Other News

LYNN SECTION DISCUSSES THE METRIC SYSTEM.

Speakers Advocate an International System Between United States, Great Britain and Russia.

The pros and cons of the metric system of weights and measures were discussed at the January 23 meeting of the A. I. E. E. Section at Lynn by L. D. Burlingame, industrial superintendent of the Browne & Sharpe Manufacturing Company; S. S. Dale, editor-in-chief of *Textiles*; and by Prof. A. E. Kennelly of Harvard University. A large attendance testified to the interest in the speakers and subject. In the absence of Prof. Adams, who was unable to come, Prof. Kennelly spoke twice and showed that even in electrical engineering the metric system is making some progress. He admitted that a complete change to the system would take time and cost money, but argued in favor of the United States, Great Britain and Russia falling in line so that there would be an international system.

Mr. Burlingame said that endless confusion would be caused in his business by the compulsory adoption of the metric system of measurements, and Mr. Dale offered an amusing record of one day's trading by a family in Chile, where the attempt to standardize the metric system has been a long and baffling effort.

The matter was left for further study and F. P. Cox, chairman for the evening, advised all to continue to ponder over the merits and demerits of the system as pointed out by the able debaters.

RATE INCREASES ASKED BY UTILITIES OF ILLINOIS TRACTION SYSTEM.

Increase in Lighting and Power Rates of 6 to 20 Per Cent Necessary to Meet Higher Fuel Cost.

A general increase in the rates of electric light and gas rates, as well as in street-railway service is asked for in a petition filled by thirteen subsidiary companies of the Illinois Traction System, the bill being presented to the Illinois Public Utilities Commission, January 31. An increase in electric lighting rates of from 6 to 20 per cent is asked. For electric railway service, the companies ask for a straight five-cent fare, eliminating all reductions in quantity sale of tickets, the straight five-cent fare being asked for in all communities served except Cairo and Jacksonville, where a six-cent fare is asked. Henry I. Green, of Urbana, Ill., general counsel for the companies, filed the bill. The companies named are the Madison County Light & Power Company of Edwardsville, the Northern Illinois Light & Traction of Ottawa, the Clinton Gas & Electric Company, the Urbana & Champaign Railway, Gas & Electric Company, the Jacksonville Railway & Light Company, the Decatur Railway & Light Company, the Danville Street Railway & Light Company, the Bloomington and Normal Railway & Light Company, the Cairo Electric & Traction Company, the Galesburg Railway, Lighting & Power Company, the Peoria Railway Company, the Quincy Railway Company and the Urbana Light, Heat & Power Company.

The petition recites that owing to the present abnormal conditions caused by the war and causing great increase in the cost of producing electric and gas service, the companies are in need of immediate relief in the form of increased rates for all public utility service rendered. Coal increases alone are said to be $350,000.

"DAYLIGHT SAVING" PLAN FOR ENTIRE YEAR RECEIVING MORE FAVOR.

Proposal First Made by Samuel Insull Being Taken Up by Central-Station Men and Urged Upon Congress.

In our issue of January 19 there was published a telegram which Samuel Insull, chairman of the Illinois State Council of Defense and president of the Commonwealth Edison Company, of Chicago, sent, on January 4, 1918, to Thetus W. Sims, chairman of the Committee on Interstate and Foreign Commerce of the House of Representatives, Washington, D. C. In substance this telegram called attention to the consideration of "daylight saving" bills by Congress, advocating that instead of confining the plan to the five summer months of the year, it be made effective throughout the year, thereby preventing the overlap of the day power load and evening lighting load of electric power plants and making a real economic saving to the nation.

This matter, first publicly advocated by Mr. Insull in his telegram, has aroused a great deal of interest among central-station men throughout the country, and a number of them have urged that this broadened aspect of daylight saving be put into effect in this country instead of the five-month plan heretofore considered alone. At present there are prospects that some daylight-saving plan will be enacted by Congress in the near future, but as to whether the Insull proposal of making it apply throughout the year will receive congressional endorsement it is still too early to say.

Before giving the figures that Mr. Insull included in his telegram, he had a study of the subject made by the statistical department of the Commonwealth Edison Company, the results of which he has given us as follows:

"Regarding the effect of moving the clock forward one hour, during the entire year, the following are the figures for the Commonwealth Edison Company, based upon the year 1917:

"The loss in revenue is estimated at $617,000, and is figured at 3 cents per kilowatt-hour generated.

"The saving in kilowatt capacity, or the kilowatt

capacity that would be released, would amount to 30,940 kilowatts, or 15.8 per cent of the capacity necessary for the supply of the light and power, exclusive of railway power.

"The saving in kilowatt-hours is estimated at 6.1 per cent of the total kilowatt-hours generated for lighting supply, or a total saving of 20,570,000 kilowatt-hours.

"The saving in coal is estimated at 2½ pounds per kilowatt-hour, and, applied to the above kilowatt-hours, amounts to 25,700 tons. I would say that this coal saving should be very considerably increased by reduction in the firing up and banking of boilers on account of the reduction in peak load.

"The above saving in capacity figured at $20 per kilowatt for fixed charges, plus the coal figured at $3 per ton, results in a theoretical net saving, on the all-year-round basis, of $80,000."

From the foregoing data, Mr. Insull computed that making daylight saving effective throughout the year would save the electric lighting consumers of the country $7,500,000, and would save more than 230,000,000 tons of coal. The effect on lighting companies would practically be offset by the improvement in load-factor because of the reduction in the winter peak.

NEW YORK EDISON SAVINGS ASSOCIATION ENJOYS PROSPEROUS YEAR.

Annual Report Indicates No Effect from Unfavorable Conditions Caused by War.

With a total membership of 2453, and with assets of more than half a million dollars, the New York Edison Savings & Loan Association has closed its sixth business year. At the sixth annual meeting dividends of 6¼ and 5 per cent were declared, and officers for 1918 were elected. The Association was organized in 1912 to encourage the saving habit among the employes of the lighting company.

The unfavorable conditions caused by the war have not prevented the association from keeping pace, with respect to its earning power, with its previous records. The membership, partly due to the war, has decreased from 2596 in 1916 to 2453 at the clase of last year. Reports, however, showed that the amount of money deposited in 1917 was $285,882, or more than $21,000 in excess of the total the year before. The smallest deposits are accepted with the result that the thrift habit has been greatly encouraged.

A new item in the dividend schedule is the shares in military suspense created for the benefit of those members serving in the Army and the Navy. To these members are apportioned dividends at the installment share rate, so that they may have their installment holdings continued without penalty for non-payment during the period of the war. Arrangements also have been effected to cover the mortgage accounts of members who are serving Uncle Sam.

The report of the treasurer showed that the association's total resources are $547,437.26, an increase of $121,666.82 over the previous year. This includes deposits by employes, totaling $486,025.09. The sum of $69,554 in dividends has been distributed to members since the association was formed. During the past year this item amounted to $26,962.

The following officers were re-elected for the ensuing year: Arthur Williams, president; A. A. Pope, vice-president; E. E. Bondy, corresponding secretary; Adolph Hertz, treasurer; I. C. Robinson, financial secretary. E. M. Van Norden, Albert Goldman, W. J. Meara and F. C. Henderschott were re-elected as directors to serve for a term of three years.

NEW YORK ELECTRICAL SOCIETY 37 YEARS OLD.

Anniversary Meeting to Be Held February 22—Rapid Increase in Membership.

On February 23, the New York Electrical Society will attain the thirty-seventh year of its existence. Upon that date, in 1881, a prominent group of telegraphers met at the old United States Hotel and organized the society, electing 121 members.

The Society as a body is to be congratulated upon a long and useful existence. Secretary Guy reports that the work of the present membership committee is briskly progressing and that a considerable increase in membership will be reported at the January meeting, as the result of a recent active campaign.

THE TELEPHONE AND THE WORLD WAR.

Address Before New York Electrical Society Describes Important Service Rendered and Dependence of Army on Telephone Communication.

In a graphic and vivid talk on "The Telephone and the World War" delivered before the members of the New York Electrical Society on Thursday evening, January 24, H. J. Carroll, of the New York Telephone Company, related many stories of the quick wit and heroism displayed by the men who are serving the trench line telephone systems.

Soon after the meeting had been called to order in the auditorium of the Engineering Societies Building, Mr. Carroll was introduced and began his recital. He told of the manner in which barrage fire is regulated by men known as "linking officers" in the British armies. These officers push on after the infantry advance, laying wires and then telephoning back to battery commanders the location of the enemy, at the same time advising the distance the fire should be shifted to be effective. Explaining how carefully the wires are guarded, he said that all of the warring armies maintain telephone patrols, which constantly test, repair and protect the lines.

Approaching gas attacks, he continued, are detected by observers whose olfactory senses are abnormally acute. Stationed at the outposts, these men, upon scenting the attack, immediately telephone the alarm to the trenches, permitting the soldiers to don their protective masks before the deadly gas arrives. Listeners, in subterranean passageways dug under No Man's Land, he related, use an instrument similar to that employed by doctors in testing heart action. In this way, tunnelling and digging by the enemy, hundreds of yards away, is detected and the word transmitted over the phone to the front lines telling of the location of the "moles."

He went into interesting detail about how the Belgians, Russians, French, Austrians and others depended on the telephone in the field. In this connection he told about the telephone central office which the Anzac troops had constructed at the Dardanelles. It was rudely put together, the walls and ceiling being entirely made from sand bags, rendering it safer when attacked.

In conclusion, Mr. Carroll described the work that has been cut out for the telephone and what it is

already accomplishing here and with the American forces abroad. In connection with this work 12,000 competent operators had been organized into a special force to handle government messages throughout the nation. Also the organization of the army under General Pershing is linked by telephone all the way from the port of embarkation to the front line trenches. He closed by declaring the telephone to be the nerves, eyes and intelligence of the army and that the Signal Corps men would play a tremendous part in the business of "Kanning the Kaiser."

It was announced at the meeting that 220 new members had been secured as a result of the unrelenting membership campaign that is driving ahead for 500, with the slogan, "Over the Top by June 1," as their incentive. Men from all electrical industries in the vicinity of New York City are eligible.

NEW YORK COMMISSION ORDERS REDUCTION IN RATES.

New Rate of Flatbush Gas Company to Conform to Brooklyn Edison Rate.

On the recommendation of Commissioner Charles S. Hervey, the Public Service Commission for the First District of New York has ordered the Flatbush Gas Company to reduce its maximum rates for electricity in the Borough of Brooklyn from twelve cents per kilowatt-hour to ten cents for the six months beginning March 1, 1918, nine cents for the succeeding six months, and eight cents thereafter, that is, beginning March 1, 1919. The order is to take effect on March 1, 1918. The Flatbush Gas Company serves the Flatbush area of Brooklyn with both gas and electricity, but the order affects only the rate for electricity. The present maximum rate of the Flatbush Gas Company is twelve cents per kilowatt-hour, while the Edison Electric Illuminating Company of Brooklyn, which serves the rest of the Borough of Brooklyn, now charges, under an order of the Commission, a maximum of eights cents per kilowatt-hour. The number of consumers served by the Flatbush Gas Company is reported to exceed 12,000, and it is anticipated that under the proposed rate ordered by the Commission there will be a saving to the consumers of the Flatbush Gas Company as compared with their present rates of nearly $90,000 annually. The order directs the Flatbush Gas Company to establish the following maximum rates: From March 1, 1918, to August 31, 1918, ten cents per kilowatt-hour; from September 1, 1918, to February 28, 1919, nine cents per kilowatt-hour; from March 1, 1919, eight cents per kilowatt-hour; from and after March 1, 1918, not more than six cents per kilowatt-hour for current consumed in excess of two hours' average daily use of maximum demand.

PROGRAM FOR MIDWINTER CONVENTION OF A. I. E. E.

Four Technical Sessions to Be Held in New York February 15 and 16.

The sixth annual midwinter convention of the American Institute of Electrical Engineers will be held February 15 and 16 in the Engineering Societies Building, New York City. On account of war conditions, the Meetings and Papers Committee, with the approval of the Board of Directors, has decided to make this convention purely a business meeting and theretofore no entertainment features or excursions have been included in the program.

The convention will include four technical sessions which will be held on Friday morning, Friday afternoon, Friday evening and Saturday morning. A strictly informal dinner will be held between the afternoon and evening sessions on Friday.

The session on Friday morning will be devoted to the subject of Circuit-Breaker Ratings. That on Friday afternoon to Meters and Measurements. The Friday evening session will be devoted to a lecture by Dr. A. C. Crehore, followed by discussion. This session will be of general interest to everyone, as the subject will be presented in a popular and non-technical manner. The session on Saturday morning will be devoted to the subject of "Alternating-Current Commutator Motors."

A more detailed outline of the program is given below.

Friday, 10:30 a. m.—Opening remarks by President E. W. Rice, Jr.; paper on "Rating and Selection of Oil Circuit-Breakers," by E. M. Hewlett, J. M. Mahoney and G. A. Burnham.

Friday, 2:30 p. m.—Papers on "A New Standard for Current and Potential," by C. T. Allcutt; "The Thermoelectric Standard Cell," by C. A. Hoxie; "The Character of the Thermal Storage Demand Meter," by P. M. Lincoln; "Measurement of Power Losses in Dielectrics of Three-Conductor High-Tension Cables," by F. M. Farmer.

Friday, 8:30 p. m.—Lecture, "Some Applications of Electromagnetic Theory to Matter," by Dr. A. C. Crehore, to be followed by discussion.

Saturday, 10:30 a. m.—Papers on "Commutation in Alternating-Current Machinery," by Marius A. C. Latour; "The Secomor—A Kinematic Device Which Imitates the Performance of a Series-Wound Commutating Motor," by V. Karapetoff; "The Polyphase Shunt Motor," by W. C. K. Altes.

IRON AND STEEL ELECTRICAL ENGINEERS APPOINT COMMITTEES.

Association Activities to Be Enlarged—Meeting to Be Held in Pittsburgh, February 16.

The Association of Iron and Steel Electrical Engineers has recently announced the new officers of the Association and the chairmen of the various committees. The officers, the majority of which were elected at the last annual meeting held in Philadelphia, are: C. A. Menk, president, Carnegie Steel Company, Munhall, Pa.; D. M. Petty, first vice-president, Bethlehem Steel Company, South Bethlehem, Pa.; B. W. Gilson, second vice-president, Carnegie Steel Company, Youngstown, Ohio; J. F. Kelly, secretary, National Tube Company, McKeesport, Pa.; James Farrington, treasurer, LaBelle Iron Works, Steubenville, Ohio; F. D. Egan, past president, Pittsburgh Iron & Steel Foundries Company, Midland, Pa.; W. T. Snyder, past president, National Tube Company, McKeesport, Pa.

Under the management of the previous administration the membership increased by 237 members during the last year. The annual convention held at Philadelphia exceeded all past conventions from a standpoint of the technical discussions. It is interesting to note that this society first organized in 1908, and five years after this the National Safety Council developed from one of the committees of the A. I. S. E. E.

For the ensuing year the following members will act as chairmen of the respective committees:

W. T. Snyder, chairman Standardization Committee, National Tube Company, McKeesport, Pa.; W. O. Oschman, chairman Power Committee, Oliver Iron & Steel Company, Pittsburgh, Pa.; A. H. Swartz, chairman Publicity and Promotion Committee, Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.; K. H. Cederland, chairman Electric Furnace Committee, Duquesne Steel Works, Carnegie Steel Company, Duquesne, Pa.; J. F. Kelly, chairman Membership Committee, National Tube Company, McKeesport, Pa.; Walter Greenwood, chairman Safety Committee, Carnegie Steel Company, Ohio Works, Youngstown, Ohio; B. W. Gilson, chairman Educational Committee, Carnegie Steel Company, Ohio Works, Youngstown, Ohio; E. Friedlander, chairman Editing Committee, Carnegie Steel Company, Edgar Thomson Works, Braddock, Pa.; A. H. Swartz, chairman Convention Committee, Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.; W. C. Kennedy, chairman Electrical Development Committee, Standard Seamless Tube Company, Ambridge, Pa.; F. D. Egan, chairman Finance Committee, Pittsburgh Iron & Steel Foundries Company, Midland, Pa.

The next annual convention will be held either in New York or Baltimore, September 9-13, 1918.

A paper on "A. C. and D. C. Skip Hoists" will be presented by Mr. Lindquist of the Otis Elevator Company at the Pittsburgh Section meeting of the A. I. S. E. E., to be held at the Hotel Chattam, February 16, 1918.

LOUISVILLE LEAGUE ELECTS NEW OFFICERS.

Two Tickets Present at Annual Jovian Meeting and Spirited Contest Takes Place.

Walter S. Clark, of the James Clark, Jr., Electric Company, was re-elected president of the Louisville (Ky.) Jovian League at the annual meeting and banquet of the league held at the Tyler Hotel on Thursday evening, January 24. Mr. Clark, elected to the presidency last fall on the retirement of President F. P. Gantt, was at the head of the regular ticket, which was opposed by the "Camouflage" ticket. Tickets were badly scratched by the hundred members who were present, and C. C. Childers, of the Childers Electric Company, and Paul Tafel, of the H. C. Tafel Electric Company, were the only two others elected to serve with him, Mr. Childers being chosen vice-president and Mr. Tafel a director. From the other ticket S. B. Storm, of the General Electric Company, was elected secretary-treasurer, and James Clark, Jr., of the James Clark, Jr., Electric Company; C. A. Klemm, branch manager of the Westinghouse Electric & Manufacturing Company, and I. Dreyfus, of the Louisville Gas & Electric Company, were elected directors from the Camouflage ticket. There were several speakers and an interesting meeting.

LIGHTING CURTAILMENT TO BE DISCUSSED.

Illuminating Engineering Society Will Consider Recent Orders of Fuel Administrator.

A general meeting of the Illuminating Engineering Society will be held on Thursday evening, February 14, in the Auditorium of the Engineering Societies Building, New York, N. Y., for the purpose of discussing the question of curtailment of lighting due to the Fuel Administration's conservation movement.

At this time also a paper will be presented by Preston S. Millar on the subject of "Lighting Curtailment." This will be discussed by prominent men in the gas and electric industry, representatives from the Fuel Administration and others concerned in the subject.

Invitations are being sent to the A. I. E. E. and the American Gas Institute to join in this meeting.

WASHING MACHINE MANUFACTURERS ELECT OFFICERS.

Annual Meeting in Chicago Held on January 22-24—War-Service Committee Appointed.

At the second annual meeting of the American Washing Machine Manufacturers' Association, January 23 and 24, 1918, in Chicago, the following officers were elected:

President, H. W. Eden, Brokaw-Eden Manufacturing Company, Alton, Ill.

First vice-president, H. W. Barker, 1900 Washer Company, Binghamton, N. Y.

Second vice-president, R. D. Hunt, Dexter Company, Fairfield, Iowa.

Third vice-president, John Rocke, Meadows Manufacturing Company, Pontiac, Ill.

Treasurer, H. W. Voss, Voss Brothers Manufacturing Company, Davenport, Iowa.

EXECUTIVE COMMITTEE.

W. J. Conlon, Conlon Electric Washer Company, Chicago, Ill.

W. L. Rodgers, Pittsburgh Gage & Supply Company, Pittsburgh, Pa.

J. D. A. Johnson, Michigan Washing Machine Company, Muskegon, Mich.

F. H. Bergman, One Minute Manufacturing Company, Newton, Iowa.

H. G. Braunlich, H. F. Brammer Manufacturing Company, Davenport, Iowa.

ADVISORY COMMITTEE.

Sam T. White, White Lily Manufacturing Company, Davenport, Iowa.

L. E. Dietz, Boss Washing Machine Company, Cincinnati, Ohio.

E. H. Maytag, Maytag Company, Newton, Iowa.

WAR SERVICE COMMITTEE.

H. W. Eden, Brokaw-Eden Manufacturing Company, Alton, Ill.

Sam T. White, White Lily Manufacturing Company, Davenport, Iowa.

L. E. Dietz, Boss Washing Machine Company, Cincinnati, Ohio.

J. D. A. Johnson, Michigan Washing Machine Company, Muskegon, Mich.

W. L. Rodgers, Pittsburgh Gage & Supply Company, Pittsburgh, Pa.

Raymond Marsh is secretary of the Association.

Contracts for More Ships Awarded.

Contracts for 46 steel steamers of 10,000 tons each that will cost a total of about $115,000,000 have been distributed by the United States shipping board among four shipbuilding companies, three of which are located on the Pacific coast. Only 10 of these ships will be built on the Atlantic coast.

"Win the War" Convention of Electrical Inspectors

Memphis Meeting of Western Association of Electrical Inspectors Discusses Many Topics of Patriotic and Timely Interest

THE thirteenth annual meeting of the Western Association of Electrical Inspectors was held at the Hotel Gayoso, Memphis, Tenn. The meeting was opened at 11:00 a. m. Tuesday and was called to order by Emil Anderson, of Minneapolis, president. After the formal opening an address of welcome was delivered by the Hon. H. H. Litty, mayor of Memphis, in which he welcomed the guests with true southern hospitality, extolling the many beauties of Memphis and offering to the delegates the entire freedom of the city with the assurance that everything possible would be done for their convenience and comfort.

The address of welcome was replied to by Frank L. Lucas, of Toledo, first vice-president of the association. Mr. Lucas took occasion to point out to the mayor some of the duties of an electrical inspector and some of the difficulties of his work and called attention to the fact that the mayor of a city was so often engrossed in the multitudinous duties of his own office that he had no opportunity to become acquainted with the really important duties of the electrical inspector.

The roll call of members showed a very encouraging response to the call of the meeting and indicated that although there is a general tendency to economize in matters of inspection the importance of the present meeting had been recognized.

President Anderson delivered his address reviewing the work of the association for the past year. This was followed by the report of the secretary and treasurer and the executive committee. The association has gained 13 members during the past year, the total membership now being 207. The records show a number of members in the service of the country. A telegram from Lieut. Berssenbrugge, who formerly represented the city of Milwaukee in the association, expressed the hope that "the time would be short before he could make a detailed report to the association on the use of concentric wiring in Berlin."

The spirit of the meeting was indicated by the title page of the official program which stated that this would be a "Win the War Meeting" with the following quotation from President Wilson: "Preventable fire is more than a private misfortune. It is public dereliction. At a time like this of emergency and of manifest necessity for the conservation of national resources, it is more than ever a matter of deep and pressing consequence that every means should be taken to prevent this evil." The spirit of this quotation was carried through the entire program and all the addresses and papers dwelt upon the importance of the conservation of the country's resources and how this could be effected by the work of the inspector.

James F. Joseph, secretary, Chicago Advisory Committee of the Conservation Committee, National Board of Fire Underwriters, spoke on "Conservation." He outlined the work covered by the association which he represented and described in some detail the responsibility of each individual in this country with regard to the part he must play in winning the war, and the particular responsibility of those who had under their supervision the care of the country's resources. He cited as an illustration the case of an owner of a small town elevator containing a few thousand bushels of grain. One of the inspectors of his organization had found such an elevator full of grain, but with no protection of any kind. The windows were broken, the doors wide open so that free access was allowed to anyone and the building was in a generally dilapidated and dirty condition. After some search the owner was found in a corner store enjoying a friendly game of rhum. It was a rather difficult matter to convince this individual that anyone but himself had any interest in his property. The building and grain were insured, so that there was in his mind, in its condition at that time at least, no reason for undue alarm. However, he was soon shown that this grain, like all other grain in storage, belonged not to him but to the people of this country and that it was only held by him as trustee for these people. The mayor of the town, who had also awakened to the real situation, took a hand in the matter and on threat of confiscation the owner lost no time in cleaning up and providing proper safeguards. Mr. Joseph, in pointing out the duties and responsibilities of inspectors with reference to the carrying on of this war, stated that authoritative figures indicated that only about 40 per cent of the actual work of the war was carried on by those at the front, those at home being charged with the remaining 60 per cent. He also made a strong plea for conservation of effort on the part of the inspector, suggesting that he confine his efforts along those lines which would accomplish the most good.

Electrical Equipment for Oil Refineries.

E. Wanamaker, electrical engineer of the Chicago, Rock Island & Pacific Railway Company, presented a paper on "Safe Electrical Equipment for Oil Refineries." The important part that fuel oils are playing in the war was outlined and the constant efforts to extract a greater percentage of such oils from the crude product was described. Under the present conditions it is of the utmost importance that every safeguard be placed around oil in storage and in process of manufacture. Mr. Wanamaker described in detail proper electrical wiring for use in these locations.

The papers of Mr. Joseph and Mr. Wanamaker excited considerable discussion. Mr. Williams of the Standard Oil Company, with whom Mr. Wanamaker is making a tour of inspection of the Rock Island properties, called attention to the patriotic duties of those upon whom devolve the safe keeping of oils. Mr. Clark, of the State of Oklahoma Inspection Bureau, called attention to features of lightning protection for oil storage tanks. On motion made by Ben Clark, of Detroit, the assistance of the Western Association was pledged to Mr. Joseph in the work which his association is carrying on. The manner of accom-

plishing the most good along these lines was discussed by Mr. Youngblood, who called attention to the advisability of placing before the mayors of the various cities copies of Mr. Joseph's paper for the purpose of obtaining the active co-operation of these officials in the inspection work. Mr. Speed made a plea for specific details in all cases where defects are reported. He stated that in his own work in connection with the Council of Defense those reports which accomplished the most good specified in detail the particulars and locations of all defects. Reports of generalities were liable to be thrown aside.

As a diversion from the regular business sessions a series of noon-day luncheons had been arranged by the electrical men of Memphis with speakers on some patriotic subject. At the Tuesday luncheon Dr. Williamson, one of Memphis' prominent four-minute men, spoke on the general aspects of the war and in a masterful and eloquent manner pointed out the duties of the individual and pleaded for the fullest co-operation with the nation's chief officers. He also took occasion to point out the moral and civic awakening which was bound to follow the first news of extensive losses at the front.

The first paper on the program for the Tuesday afternoon session was on "The Use of Electricity in Winning the War" by J. W. Hicklin, of the General Electric Company. This paper had to be abandoned to avoid the possibility of giving information to the enemy. W. E. Clifford, of the Forest Product Chemical Company, of Memphis, presented a paper on the "Use of Forest Products in the Production of War Munitions." He dwelt particularly on the manufacture of hardwood distillates and traced the process in use back to the original discovery of the production of charcoal. The present-day methods in the production of hardwood distillates were described in detail together with the electrical features of the operations employed. The use of distillates in the manufacture of munitions was also described.

Economies in Grounding.

Owing to the fact that some of the subjects specified for the Tuesday session were omitted, the program was advanced and a paper covering "The Central Station's View" on the general subject of "Rational Economies in Grounding" was presented by Carl K. Chapin, of the Memphis Gas & Electric Company. The system of grounding as developed and used by the Memphis company was described. This system varies somewhat from the usual practice, the company following the principle that the lighting company is the most interested in the maintenance and safety of its own lines. An artificial ground is provided for the primary system with a ground detector which will indicate even slight grounds, such as those caused by tree limbs. On the secondary system but one ground is provided and that is placed at the transformer, this ground being obtained by burying a metal plate at moisture level. No attempt is made to provide additional grounds either at other points on the secondary distributing system or at the individual services. The ground plates and their connections are subject to periodical inspection and test in an endeavor to keep them in good condition. It is recognized that with this method of grounding a ground on the house circuits will not, under ordinary circumstances, clear itself by the blowing of a fuse but will continue on the system until detected by the householder or meter man. The grounds provided at the transformer are the primary and secondary circuits and prevent a dangerous rise in potential in the house wiring system. Mr. Chapin stated that with several years' experience with this method of grounding, he was satisfied that accidents from fire or shock were reduced to a minimum.

At the Wednesday meeting the Electrical Contractor's View of the question of grounding was presented by C. B. Rutledge, manager of the Bluff City Electric Company, of Memphis; and the Bureau of Standards View by Mr. Wagner of the Bureau. The reading of these papers brought out an animated discussion and developed some differences of opinion. Mr. Chapin recommended for consideration by the Bureau the substitution of potassium hydroxide for sodium chloride as a grounding salt. He stated that sodium chloride had a number of disadvantages which were either entirely or partially eliminated by the use of the potassium salt. Mr. Rousseau in discussing the Memphis system of grounding called attention to the fact that his inspections of country districts showed that transformers are often operated for years without any replenishment of oil and that transformer breakdowns are therefore quite common. Mr. Chapin stated that in the Memphis system the cases of transformers were not grounded as provided in the National Electrical Safety Code. He justified this by the opinion that an insulated case was safer from the standpoint of a workman on a pole. This brought out a discussion of the protection of ground wires on poles, and Mr. Wagner, of the Bureau of Standards, described an insulated fiber conduit for this purpose, which, he stated, was coming into common use. The discussion of the secondary grounding showed plainly that the division of responsibility between the lighting company and the consumer was not by any means clearly defined. This was illustrated in the case of the city of Louisville, where a controversy has arisen over the installation of the wire which grounds the neutral of the system. Local rules require the neutral to be grounded at each installation and a decision was requested as to whether this wire should be installed by the wiring contractor or must be installed by the lighting company.

Frank Daniels made a plea for closer co-operation between the authorities and the lighting companies in the solution of this and similar confusing problems. Secretary Boyd complimented Mr. Chapin and the Memphis company on their stand in regard to grounding and while he did not agree entirely with the opinions expressed, he appreciated the effort to obtain a proper solution of the question and called attention to the benefits derived from a serious discussion of opposing views.

Signaling Versus Lighting and Power Systems.

At this point in the session of the inspectors' problems was brought up for discussion: "What characteristics distinguish the difference between an electric signaling system and a light or power system." This proved to be an interesting subject and it was discussed by practically all members present. In explaining the problem it was pointed out that the Code does not define these two systems, and that in one case an installation containing certain apparatus might be classified as a signal system and permitted to be wired with ordinary bell wire, while in another case exactly the same apparatus might be classified as a light or power system and be required to be wired in accordance with Class C of the Code. It was pointed out that inspection departments in general would not accept an installation of a push button and an electric

bell when connected to a 110-volt system unless the wiring and apparatus complied with Class C rules. However, certain approved apparatus made use of bell circuits on 110-volt circuits and was wired with bell wire. It was finally agreed that the question should be left to the Underwriters' Laboratories and that inspection departments would accept installations of this type only when the apparatus had been approved by the Laboratories.

A complimentary dinner to the members had been arranged for Tuesday evening. W. R. Herstein, of Memphis, presiding. Short addresses were made by local representatives of the electric industry and by members of the Western Association. Most of the talks reflected the spirit of the convention and many references were made to the work of the war.

At the Wednesday session of the convention, A. R. Small, vice-president of the Underwriters' Laboratories, spoke on "The Underwriters' Laboratories and the Great War." He described in detail the part the Laboratories were taking in this great struggle and called attention to the vast amount of approved apparatus used in the construction of war machinery and cantonments.

John W. Kelly, Jr., chief of the Electrical Bureau of Camden, N. J., read a paper on "What the Fire-Alarm Superintendent Can Do to Help Win the War." Mr. Kelly dwelt particularly upon the importance at this time of the safeguarding of plants and the prompt transmission of fire alarms. With many large warehouses filled with stores of goods which must be used by those on the fighting line, the question of their proper safeguarding becomes of prime importance. He cited an instance of watch service which had come to his attention where six investigators had entered the building, drawn plans of four floors, taken two flashlight photographs and obtained access to all parts of the building without the watchman knowing anything of their presence. When the report of these men was submitted to the officials in charge of the building, it is needless to state that prompt action was taken to remedy conditions. Mr. Kelly states that this is not an unusual condition and is one that can only be remedied by a full awakening to the actual conditions.

L. S. Keilholtz, chief engineer of the Domestic Engineering Company, Dayton, Ohio, presented a paper on "The Farm Lighting System and War Service." In addition to a general description of the electrical features of the apparatus he described the plant as it has been applied to war service.

At the Wednesday luncheon a talk was given by one of Memphis' four-minute men. This was followed by a talk by Mr. Murray, of Memphis, who strongly urged upon those present the necessity for a systematic co-operation in the endeavor to conserve the country's resources.

Committee Reports.

The afternoon session was devoted to committee reports. The report of the Committee on Outside Wiring, F. W. Derby, chairman, drew attention to overhead construction in country districts outside the jurisdiction of inspectors. Poor construction in these territories, of which there appears to be a great deal, endangers other overhead wires entering the cities by becoming crossed with the same. The report of this committee was referred to the Executive Committee of the association for action.

The report of the Committee on Show Window and Display Lighting, Fergus P. McGough, chairman, brought out the fact that the use of the letters sent out by this committee had served to reduce to a considerable extent the loss usually occurring from Christmas decorations in show windows. This report was discussed by Messrs. Clark, Cochran, George and Young, all of whom had made use of the letters referred to.

A report on the Wiring of Electric Elevators was presented by the committee in charge of this subject, H. M. Maxwell, chairman. The report brought out a lengthy discussion. Ben Clark described the experience in the city of Detroit. Messrs. Dugger, Rousseau, Martin, Lucas and Strubbe also referred to various features of the report. It was finally referred back to the committee with instructions to formulate rules covering this class of wiring.

The report of the Committee on Demand Factor, Guy W. See, chairman, showed that considerable progress had been made in the investigation of this important subject. It was realized, however, that a great amount of work remains to be done before the matter is in shape for final adoption and as this subject has to do with a means of conserving some of the principal resources of the country—copper and steel—it was decided that the committee should be enlarged and the work subdivided and that it should report to the Executive Committee of the Association as soon as definite rules were decided upon so that the information might be conveyed to all members of the Association.

Reports were also received from the Committee on Electric Traction Systems, Frank Daniels, chairman, and from the Committee on Architects' Specifications, F. H. Moore, chairman.

The Thursday meeting was devoted to a consideration of inspectors' problems, of which 15 had been presented, covering various phases of inspectors' work.

On Wednesday evening a banquet was provided, at which J. P. Norfleet, of Memphis, presided, and on Thursday evening the delegates were entertained at a theater party.

Resolutions were presented to the Association on the death of two of its members, Ralph E. Knox, of Louisville, and James E. Latta, of the Underwriters' Laboratories.

Next Meeting in Chicago.

It was decided to hold the next meeting in Chicago and, due to the present activities of our country, dispense with the usual entertainment and devote the entire time to the business of the Association.

The following officers were elected for 1918:

President, Frank L. Lucas, Toledo, Ohio.

First vice-president, Charles K. Cregier, Chicago, Ill.

Second vice-president, K. W. Adkins.

Secretary and treasurer, William S. Boyd, Chicago, Ill.

Spring Meeting of American Electrochemical Society.—The proposed spring meeting of the American Electrochemical Society consisting of a six-day trip through the southern states from Washington may be called off in view of congested railroads and curtailed passenger trains, although prominent railway men say railroad transportation will be in a condition more nearly approaching normal before the spring convention. If insufficient persons come forward to take the proposed trip, or lacking railroad facilities, the trip will be abandoned and the convention held at a fixed place, such as Chattanooga or Atlantic City.

Commercial

Electric Refrigeration for the Butcher—Pittsfield Iron Campaign—Other Central-Station Sales Activities

ADVANTAGES OF ELECTRICAL REFRIGERATION FOR THE BUTCHER.

Shortage of Natural Ice and Cost of Handling Makes Subject of Timely Interest to Central Stations.

Among the earliest users of artificial refrigeration were the packing houses. Their enormous demands for a cooling agent readily led them to investigate and accept the claims of the advocates and builders of refrigerating machines. Their use in a large way naturally led to a desire on the part of the wholesalers and eventually of the retailer, for similar machines, smaller outfits, to produce in a small way for their purposes, results equally effective. The builders were equal to the emergency and today the handlers of meat, from the abattoirs to the ultimate distributors, constitute by far the largest proportion of those using refrigerating machines in this country.

Meat is a very perishable commodity and if it is to be kept in the best of condition, requires the best possible conditions in its surroundings. The shortcomings of cooling by means of ice are accentuated in this business because the damp, musty atmosphere makes the meat slimy on the surface, requiring considerable trimming to waste if the meat has been exposed to such an atmosphere for any length of time. More than one butcher has been able to make the statement that the saving of trimming losses has been nearly sufficient to pay power bills for the refrigerating machine.

The best system for the retail butcher is direct expansion, used either with automatic thermostatic control or with the auxiliary brine tank. Where special rates for electric power are given for off-peak agreements, the automatic control cannot, of course, be used without some special cutoff switch. A uniform temperature of 34 to 36 degrees is the best to keep meat in a perfect condition. If the temperature is reduced much below 32 degrees, beef will darken and look unsightly. With the non-automatic machine, an auxiliary brine tank should be used. This acts as a storage reservoir and maintains a lower temperature than would otherwise be possible over nights, Sundays and holidays when it is inconvenient to operate the ammonia compressor.

Plenty of insulation on the boxes is an economy, and where windows are used, three to four thickness of glass should be used. It costs money to produce the low temperature in the box. When this is permitted to leak, there is a continual added expense. A dollar expended for improved insulation will save many dollars' worth of electric power in the life of the outfit. Granulated cork, covered with cement and kept dry, has proved to have as good or better nonconducting qualities than any other substance in use today.

Every retail butcher nowadays has as part of his equipment a meat grinder for preparing sausage or hamburg steak. These are very generally operated by motor. The amount of electricity consumed is nominal, but the time and labor saved over a hand-operated cutter are considerable. A very wise practice which has been adopted by some is to set up this cutter in the refrigerator box. By so doing the necessity for cleaning it every hour or so in hot weather is avoided.

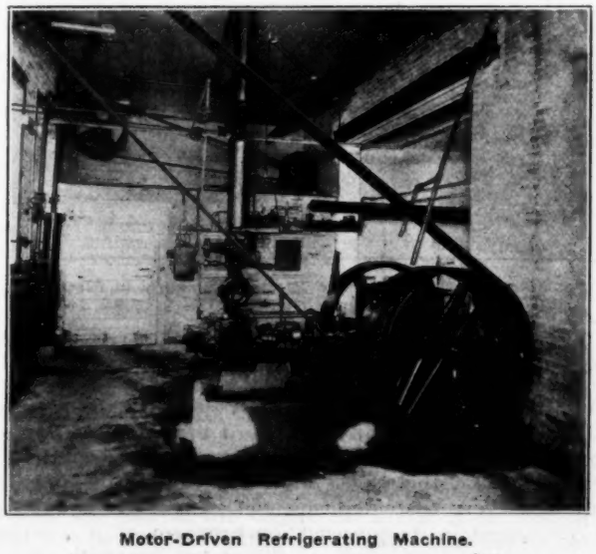
Several sizes are on the market for both direct and alternating-current circuits, built as a unit with the motor and machine on a common base and a worm-gear drive, with capacities as follows:

0.5	horsepower.	Capacity per hour,	200 pounds.
0.75	horsepower.	Capacity per hour,	300 pounds.
1	horsepower.	Capacity per hour,	400 pounds.
3	horsepower.	Capacity per hour,	1500 pounds.

The capacities have reference to beef. Pork is cut more easily and faster, so that the capacity in pork will be about 75 per cent higher.

In certain localities retail butchers have also found it profitable to install bone grinders for making chicken feed. Ground green bone makes excellent food for chickens and inasmuch as bones are usually thrown into the waste can, considerable profit can be made through this means. Bone grinders are made in a variety of sizes up to 15 horsepower or more. The smallest mill using 2 or 3 horsepower is the most suitable size for the ordinary store. Stores located near railroad stations, which catch the trade of commuters and suburbanites, would do well to feature this proposition, as this class of customer usually makes a practice of keeping chickens.

Another thing that the retail butcher should know and secure the benefit of is the improved appearance of meat, especially beef, under the tungsten light. The rich red color of good beef can be brought out so well



Motor-Driven Refrigerating Machine.

in no other way. Some butchers purposely keep artificial light burning all day long for the advantage it gives in the improved appearance of their stock. It is probably unnecessary to cite the other advantages of electric light in the absence of heat and gases both inside and out of the refrigerator compartment.

As before stated, the automatic refrigerating machine is especially useful for the retail butcher. It maintains an even and uniform temperature whatever the weather may be outside, provided, of course, the demands are within the capacity of the machine. Other conditions remaining the same, an ammeter chart of an automatic machine would be a good temperature record of the weather.

They are made in sizes as follows, the capacity referring to pounds of melting ice each 24 hours:

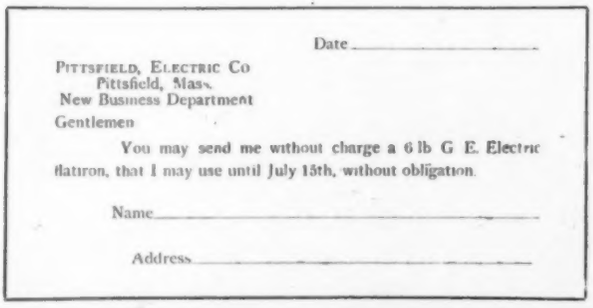
Horsepower	1	2	3	5	7.5
Pounds capacity	710	1550	2740	4550	7150
Horsepower	10	15	20	25	30
Pounds capacity	9800	15000	20900	26700	32600

Indianapolis Company Appeals to Children in Patriotic Advertising.

The Merchants Heat & Light Company, Indianapolis., Ind., is doing some patriotic advertising in urging the sale of thrift stamps and war-savings certificates. This company has generously given much of its advertising spaces in the Indianapolis papers to publicity work for the "baby bond" issues. The company says, in making a direct appeal to the Young America of Indianapolis and vicinity: "Little people can help in the big war. Let every child start an estate. 25 cents starts a thrift card. Sixteen thrift stamps starts a $5.00 war-savings certificate. The child of today will be doing his mite. The man of tomorrow will have the best security in the world."

Pittsfield Company Conducts Iron Campaign as a Conservation Measure.

The Pittsfield (Mass.) Electric Company has inaugurated an electric flatiron campaign that has a special appeal because of its object to help in the conservation of fuel. In homes where coal or gas ranges are employed there is a notorious waste in heating the



Date _____

PITTSFIELD, ELECTRIC CO
Pittsfield, Mass.
New Business Department

Gentlemen

You may send me without charge a 6 lb G E Electric flatiron, that I may use until July 15th, without obligation.

Name _____

Address _____

Post Card Used by Pittsfield Electric Company in Flatiron Campaign.

old-style flatiron, it not being uncommon to find ranges being operated to full capacity in order to keep one or two irons sufficiently hot.

As an indication of the faith of the Pittsfield company in the merits of the iron, not only as a convenience but as a fuel saver, a six-months' trial is being allowed every customer who will co-operate with the Government in its conservation program.

A return post card, as illustrated herewith, has been sent to every customer not already using an electric iron. A standard $5.00 iron is loaned to every customer availing himself of the offer and if it is desired to retain the iron at the end of that period arrangements can be made for partial payments of 50 cents per month.

Louisville Company Has Surplus Capacity for New Business.

The Louisville Industrial Foundation of Louisville, Ky., announces as a matter of interest to manufacturers of war material that the Louisville central station has at this time more than 10,000 kilowatts in surplus power available for industrial purposes. This central station owns the mine from which its coal supply is furnished in its own coal cars. The mine is only one night's run from Louisville, and thereby the central station can secure the abundant supply of coal necessary to assure a continuity of electric power. It is further stated that the movement of residents to suburban districts has left several thousand dwelling houses in the main part of Louisville suitable for employees of industrial plants at moderate rentals. The organization named offers to assist manufacturers in securing the necessary floor space, labor and power required in opening plants for the production of war material.

Stockton Company Adds 1205 Customers in 1917.

During the year 1917 the Western States Gas & Electric Company, Stockton, Cal., added 1205 electric consumers to its line, of which 210 were power consumers. The increase in connected motor load amounted to 2485 horsepower. Gas consumers increased 863. Electric appliance sales during the month of December were as follows: 139 toasters, 275 irons, 59 percolators, 63 grills and 406 heaters. A five-year street lighting contract has been closed by the Western States Gas & Electric Company with the city of Plymouth. Resources of Stockton banks have increased more than $10,000,000 during the past 18 months. On June 30, 1916, resources amounted to $24,074,000, and on December 31, 1917, the total was $34,243,000, indicating the increase in commercial, manufacturing and agricultural activities in Stockton.

Commonwealth Edison Company Helps Poor Obtain Coal.

During the recent cold spell and coal famine the Commonwealth Edison Company distributed some 8000 tons of coal from its storage piles amongst the poorer people. The Fisk and Quarry Street station coal piles were thrown open to the poor people and coal sold in sacks of 85 pounds each. The price charged was 25 cents per 85-pound sack, a price 15 cents below that quoted by the fuel administrator. Some 160 carloads were thus made available. On the Northwest side, at the Northwest station, some 100 cars of coal were made available to residents in the neighborhood, as fast as it could be hauled away.

Arkansas Valley Company Experiments With Girls as Meter Readers.

The Arkansas Valley Railway Light & Power Company has employed several girls in the capacity of meter readers. If the innovation is a success, the force will be enlarged.

Operating

Water Supply for Transformers—Causes and Palliatives of Clinker—Cross-Arm Braces for Transformer Poles

SOME PERTINENT FACTORS GOVERNING WATER SUPPLY TO LARGE WATER-COOLED TRANSFORMERS.

Supply in Duplicate, and Meter Testing Facilities, Can Be Inexpensively Obtained.

By Harold K. Brown.

The large water-cooled oil-immersed transformer has usually more dependence placed upon it than the smaller oil-immersed units, because the load served is larger. One of the most important safeguards required with this type of unit is that of assuring continuity of cooling water at all times; and every reasonable precaution is justified in obtaining such safeguards. Allowing for hot spots in the transformer windings it is customary to consider 80 degrees centigrade as the maximum safe operating temperature of the oil. With a unit hot and operating full load cessation of the water to the cooling coils will endanger the transformer in a short time.

The money invested in water piping is almost always a very small one compared with the cost of the transformer itself. And yet it is often found that to obtain a small saving in installation costs the water pipes are installed without due consideration as to flexibility and the occurrence of abnormal conditions. The piping should be laid out so that interruptions either outside or inside the station will not interfere with operation of the transformer, nor jeopardize its safety.

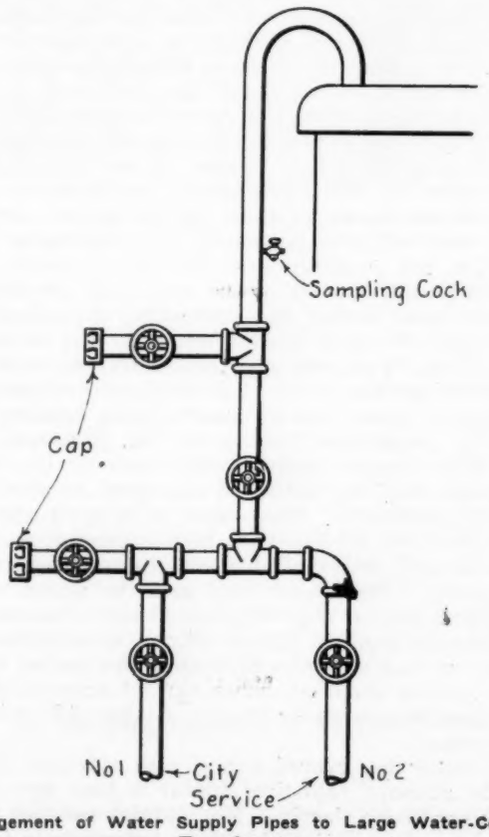
Duplicate Water Supply.

For large transformers, of 2000 kilowatts and above, serving important loads, it is usually considered best to have two independent piping systems from the sources of city water supply. These should preferably come to the station from different directions and along different routes in distinct and entirely separate mains. Thus if the one main bursts or streets are obstructed by fires and other causes at least one source of water supply remains available. Pipes do break in our cities, and this occasions delay of from a few hours to a day or more. Again, fires occurring between the source of water supply and the water-cooled transformer may cause such a drop of pressure that insufficient water passes through the transformer for cooling purposes. By having duplicate water mains, coming from different directions, emergency interruptions can be guarded against.

When cooling water is obtained from city water supply, it is preferable to insist that the city's water meter be installed in the station where it can be read conveniently, instead of being installed out in the street, where it is much less accessible. Water meters should be read regularly, daily, weekly, or monthly as circumstances decide, and recorded. This can be more easily done where the meter is installed in the station instead of out in the street.

Flexible Piping Arrangement.

An arrangement of water piping that offers a number of advantages is shown in the sketch, an arrangement that at once is compact, flexible, yet not expensive. From the sketch it will be seen that there are two incoming pipes from the water supply, each controlled by its own valve. There is a main control valve that controls both incoming water pipes. To the left there are two more valves in pipes that are shown plugged. These pipes are used for test purposes. With large transformers operating at high load factor it may be advisable to check the working of the city water meters quarterly or semi-annually, because the water metered may amount to a considerable item. Periodically a water meter may be installed at the two plugged pipes after their plugs have been removed. The two controlling valves are then



Arrangement of Water Supply Pipes to Large Water-Cooled Transformer.

opened and the main valve closed. In this way either of the two water meters in the basement on the two incoming pipes may be checked without spilling water or interrupting its supply. A cock will be noticed above the valves, the object of which is to enable water to be drawn off, that the operator may determine

whether the cooling water is muddy or is otherwise likely to cause trouble in the coils, such as often happens after floods, storms and so forth by draining off a sample.

Without its cooling water the water-cooled transformer is useless for sustained full loads. The water piping system represents only a small part of the cost of installation, and one with extremely small upkeep cost. Care and forethought in designing the water supply is therefore very important, since upon it depend the life and performance of the transformer.

SOME CAUSES OF CLINKER AND THEIR PALLIATIVES.

High Ratings, Low Ash-Fusion Temperatures, and the Underfeed Stoker Are Amongst the Chief Causes of Clinker.

By Lionel Linnell.

The large majority of coal users in the Middle West have for many months been unable to obtain the coals to which they were accustomed and for which their equipment was adapted. Instead they have had to take whatever coal could be obtained, and this has in many instances taken the form of low-grade coals, high in volatile and also high in ash and dirt, and of variable size and quality.

In the endeavor to maintain capacity, and even increase it, with these low-grade coals intense drafts have been necessary to overcome the dense and thick fuel beds, clinker-clogged grates, and maintain high rates of combustion. Not infrequently trouble has been reported on account of slag and small particles of clinker being carried up to the bottom boiler tubes of the first pass and there adhering and collecting until intervening spaces have become entirely bridged across and sealed up with fused ash and ash particles. This growth on the boiler tubes should not be confused with soot, which is an indication of incomplete combustion, but is rather an indication of intense draft and high ash content of the coal, with possibly improper boiler setting and broken fire, depending upon the type of stoker used. Whatever the cause, the occurrence is objectionable as it interferes with heat transfer and may be expected to cause overheated and weakened tubes, thus at once reducing capacity, suggesting dangers and adding to cost of upkeep. All of these assume greater importance at the higher ratings, while the increased resistance to air flow is also objectionable. The bottom tubes are particularly susceptible to mishap with high ratings such as are feasible and often desirable with the underfeed stoker, because of the intense heat and the action of the above-mentioned slag. Mechanical soot cleaners have apparently found it rather difficult to maintain these tubes in good condition because of the intense heat in the furnace chamber, hence careful supervision and continual watchfulness at such a vulnerable point are important.

Clinker has played havoc with side and bridge-walls, although palliatives appear to have been found with surprising alacrity. Not all brick troubles should be charged to clinker, however, but many to inexperience in their use. Boilers have been set up higher, furnace chambers have been given additional volume, and various combinations for preventing smoke and increasing efficiency have in some instances been tried without sufficient knowledge of the conditions to be met, the characteristics of firebrick and their limitations. Boiler settings, furnace chambers and stoker installations are matters requiring engineering knowledge and should no longer be undertakings devolving upon bricklayers and blacksmiths. Realization of this fact would have saved much time and gone a long way to reducing excessive maintenance costs and unfortunate service interruptions.

Clinker troubles have brought home the truth to many that one grade or characteristic of a brick does not make it the most efficient for all locations in a furnace. The choice of brick should be made upon an understanding of the conditions to which it will be subjected, from which the prepondering requirement such as its ability to withstand abrasion, erosion, intense heat and radical temperature changes or pressures is at once apparent. There is no brick fulfilling all of the requirements, and it is usually a matter of sacrificing one for another. It is the best thing to do, however, in any case and will be found to extend the limitations as to forcing now imposed by the brick in probably most instances. For example, the material used for the side-walls, although having high heat-resisting characteristics, must to greater extent have the ability to resist abrasion due to clinker and the abuse accorded it from clinker cutters, slice bars and pokers. The requirements of refractory arches are entirely different again, and so on. The chemical composition of bricks is also an important factor in limiting performance at high ratings and when compared with the analysis of the ash and clinker in predicting the likelihood of trouble on account of clinker acting as a flux for the brick. Considerable trouble has been encountered from this cause.

Incipient clinker formation on side and bridge-walls should be prevented by every possible means, otherwise premature failures are to be expected. The air and steam-ventilated walls and arches have done much to mitigate this form of trouble in the furnace chamber. Water-cooled back and side-walls are also giving very good results where properly applied, and have gone a long way toward removing one of the most serious by-products of the underfeed stoker when operating around 300 per cent rating with low-grade coals. Iron-faced linings with water-cooled backs have also proved effective in reducing wall troubles by preventing the formation of clinker and clinker growth and the erosion and crumbling that follows. Short life of the metal faces has been reported in some cases where used with underfeed stokers and also when applied to side walls to reduce the continual erosion that accompanies movement of the fuel bed with chain grates. One of the chief objections advanced against the water-jacketed wall has been that cessation of the water-cooling results in burnt-out brickwork, and that dependence upon manual water replenishments has thus caused endless trouble and expense. While automatic control of the water for these water-cooled walls is perhaps not usually justified, the same benefits may be obtained by by-passing a portion of the boiler feed-water through the wall-cooling system. Doing this assures ample cooling of the walls at all times and is as efficient as it is effective since the heat absorbed by the feed-water is heat usefully utilized to the benefit of the overall efficiency of the plant.

Not a little clinker trouble has been caused by improper manipulation of the fuel bed by unskilled labor or labor ignorant of operating mechanical stokers. Moreover, many plants are running continuously at from 175 to 275 per cent rating with coals once thought could be burnt only on chain-grates. While clinker has caused trouble with brickwork in the furnace, it has probably caused more trouble outside of it.

Repairing Leaks in Pipes.

By R. A. Rossman.

Sometimes a cast or malleable-iron pipe fitting will leak through its side. The water oozes drop by drop from a pin hole. Such a leak is ordinarily due to a sand hole in the casting. A means which is often effective for correcting such a difficulty is this: Hammer the location where the water oozes out with the peen (ball) end of a hammer. If this does not close the orifice and prevent further leakage, it is then necessary to replace the fitting. Where the leak is around the thread, screwing the pipe or fitting tighter constitutes the only practicable and, usually, an effective correction. Pipes containing steam should not be repaired until steam pressure has been removed from the steam line.

Improved Location of Cross-Arm Brace for Transformer Poles.

Line construction has long tended toward greater simplicity, greater reliability and reduced cost and improved details often suggest themselves toward this end.

In Fig. 1 is shown a typical transformer pole carrying a standard distributing transformer. The brace is installed below the cross-arm and supports the end of the cross-arm farthest from the pole to which it is anchored. This construction answers the purpose for the smaller transformers, but for the larger sizes gets in the way unless made of greater length, which necessitates bolting to the pole nearer the earth, which is undesirable and is a less rigid construction.

Fig. 2 shows a brace installed above the transformer and cross-arm instead of beneath. The brace is in this case entirely out of the way of transformer, however large its capacity, and movement of men on the pole is in no wise interfered with. This latter arrangement of cross-arm brace is being tried out on one large distributing system.

The installation of the brace below the cross-arm affects the men less than it does the transformer setting since in replacing blown fuses, inspecting lightning arresters and so forth the lineman usually climbs up the pole on the opposite side to which the transformer is hung or to which the brace is fastened.

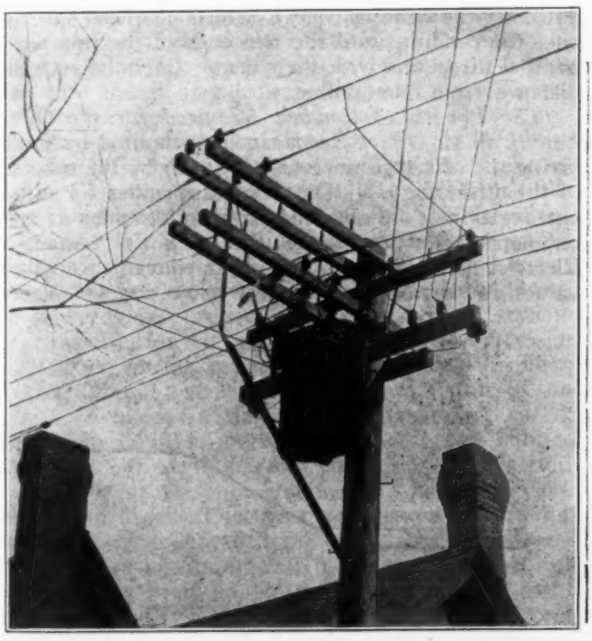


Fig. 1.—Transformer Pole With Brace Underneath Cross-Arm, Showing How It May Interfere with Transformer Mounting.

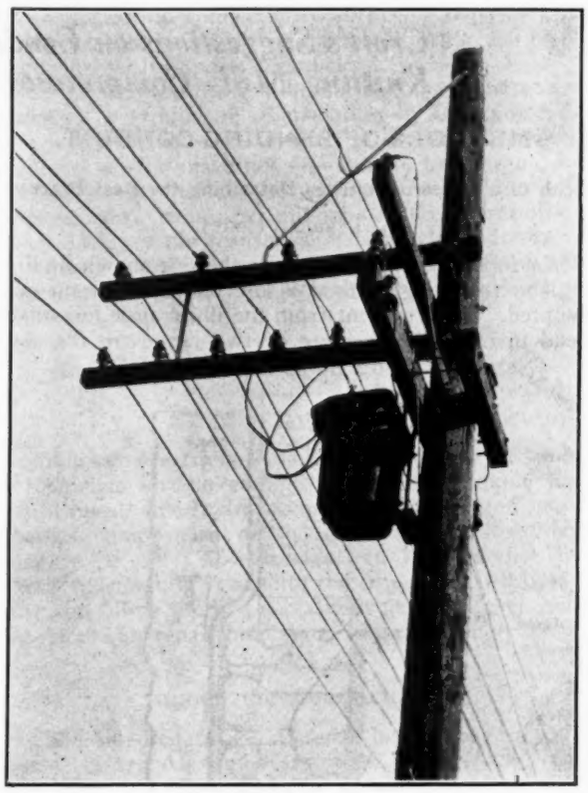


Fig. 2.—Transformer Pole With Brace Above Cross-Arm, Showing Absence of Obstructions Below Transformer.

With the brace above, however, somewhat greater care must be exercised since with this latter arrangement the brace is in close proximity to the high-voltage primary whereas with the former arrangement, namely, below the cross-arm, it is below the secondary of low-voltage conductors.

Installing the brace above instead of below the transformer, for a given distance of conductors above the ground, obviously necessitates a higher pole. Pole prices are usually based upon diameter at base and top, as well as height. Although the length of pole is increased in the present instance the diameter at the transformer remains the same in the two cases, hence there is little if any difference in the cost of poles with the two arrangements of cross-arm braces, although one pole is higher than the other.

Carrying Capacity of Copper Wires.

By Herbert A. Lane.

We have often tried to find some data regarding the safe current-carrying capacity of copper wires used in testing work or any other similar temporary work where the wires can always be watched but have never been able to locate anything conclusive. From our own experience, however, we believe that for leads for temporary testing work, insulated conductors will safely carry currents about double those given as safe values in Rule 18 of the National Electrical Code.

Construction

Croft's Suggestions on Conduit Bending—Motor Drive in a Knitting Mill—Commutator Troubles—Among Contractors

METHODS OF BENDING CONDUIT.

Fifth of a Series of Articles Describing the Best Practice.

BY TERRELL CROFT.

In Bending Offsets, such as the one shown in Fig. 28, the following method is the one most frequently adopted. As is evident from the illustration, an offset bend involves the forming of two curves in the conduit, the extending ends of which must lie in directions parallel to one another.

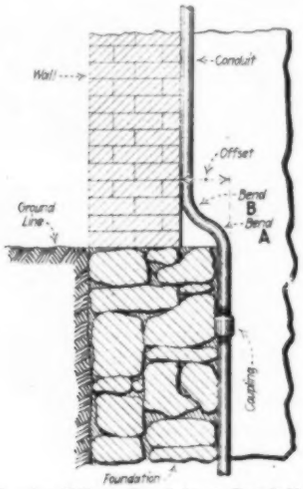


Fig. 23.—An Offset Bend in a Conduit Run.

The first bend (A_1, Fig. 29) is made with a hickey in the manner described in the first article of this series (see issue of January 12, 1918). This bend is not ordinarily one of 90 degrees, however. Then to make the second bend *B* the conduit is laid on a plane raised above the surrounding surface. Such a plane may be the floor of a porch or the top of a box or bench. By placing the hickey over the conduit as suggested in Fig. 29 and forcing it in the direction indicated by the arrows, the second bend *B* can be formed, the first bend then taking the position A_2.

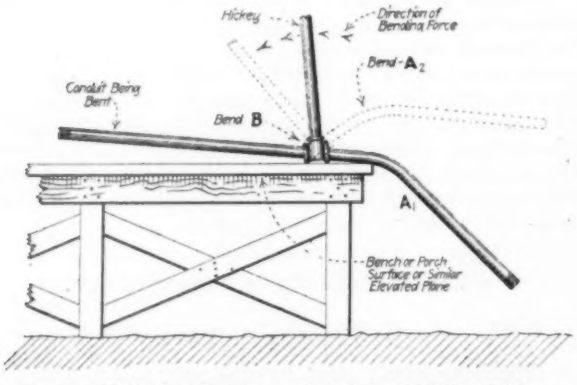


Fig. 29.—Method of Making an Offset Bend With a Hickey.

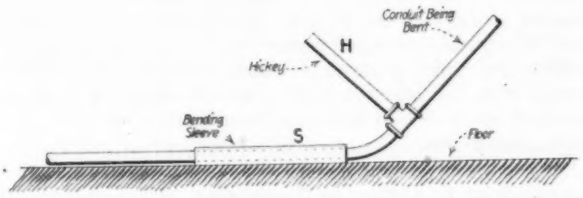


Fig. 30.—First Operation in Forming an Offset With a Bending Sleeve and a Hickey.

Another Method of Forming an Offset is shown in Fig. 30. This involves the use of a hickey *H* and a bending sleeve *S*. In forming the first bend, the tools are arranged as shown in Fig. 31. To make the second bend the short-handled hickey is braced against the floor (see Fig. 30) and the wireman forces down on the bending sleeve, which has been inserted over the conduit, until the two ends of the tube lie in parallel directions with their center lines the requisite distance from one another.

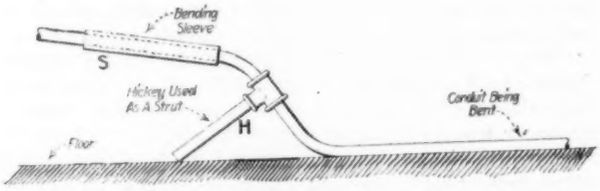


Fig. 31.—Second Operation in Forming an Offset With a Bending Sleeve and a Hickey.

The Length of Conduit Required for the Offset Length in an Offset Bend can be computed by multiplying the offset distance (*O*, Fig. 32) by the cosecant of the offset angle *A*. These cosecant values for different angles may be obtained from most tables of trigonometric functions (see the author's "American Electrician's Handbook"). For convenience, these values for each 5 degrees between 0 and 90 degrees

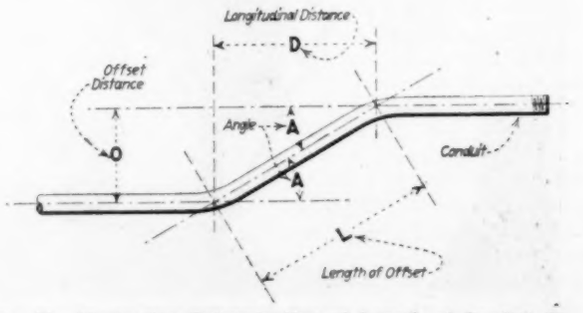


Fig. 32.—Illustrating Determination of Length of Conduit Required for an Offset.

are herein given in Table II. Likewise, the longitudinal distance (*D* in Fig. 32) may be obtained by multiplying the offset distance by the cotangent of the angle *A*.

TABLE II—SHOWING RELATION BETWEEN OFFSET ANGLE, LENGTH OF OFFSET, AND DISTANCE BETWEEN CENTERS.

(Multipliers used to obtain length of offset L and longitudinal distance of offset D, when offset distance O is known. For reference letters see Fig. 32.)

A Offset Angle.	To obtain L Multiply the distance O by the following constant. (This constant is really the cosecant of the angle A).	To obtain D Multiply the distance O by the following constant. (This constant is really the cotangent of the angle A).
5	11.47	11.43
10	5.76	5.67
15	3.86	3.73
20	2.92	2.75
25	2.37	2.14
30	2.00	1.73
35	1.74	1.43
40	1.56	1.19
45	1.41	1.00
50	1.31	0.84
55	1.22	0.70
60	1.15	0.58
65	1.10	0.47
70	1.06	0.36
75	1 04	0.28
80	1.02	0.17
85	1.004	0.09
90	1 000	0.00

(To be continued.)

EXPERIENCES WITH MOTOR DRIVE IN A KNITTING MILL.

Details of Installation at Plant of Wayne Knitting Mills—Central-Station Power Used.

The Wayne Knitting Mills, Fort Wayne, Ind., uses in electric power about 50,000 kilowatt-hours per month for operating 100 motors, aggregating 300 horsepower. These comprise both direct-current and alternating-current motors, running at 110 volts and ranging in capacity from 1/16 to 30 horsepower. The greater number of machines in the factory have individual motor drive. However, some useful tests have been made with group drive to determine power costs as compared with those of individual drive. In operating a group of 20 knitting machines from line shafts driven by a 15-horsepower motor, it was found the cost was $1.20 per day for power, based upon 9-hour runs, with energy at 2 cents per kilowatt-hour. Taking into account the costs of equipment for the two systems, the advantage is considered in favor of the group drive for this class of machines, which are the Schubert & Sulzer full-fashion type. In this work the speed is increased or decreased by shunt field control.

In the silk mill, occupying a separate factory space, in which direct-current motors are used, a change was made to alternating current at 220 volts, three phase, and power was purchased from the central station. This was tried on 20 sectional machines to carry out the plan of getting proper speed control by using a slip-ring motor; but it was found unsatisfatcory on account of too low a torque at the necessary speed. Then a single-phase motor with transformer control was tried, and while starting conditions were better, the experiment was not completed. The conclusion was that in order to secure proper speed control for silk machines of delicate mechanism, it will be necessary to install an 80-kilowatt motor-generator set for producing the required power for the direct-current motors originally installed. The alternating-current motors put in the silk mill for trial there will be moved to and installed in the cotton and woolen knitting mill.

In this class of manufacture it is essential that all dirt and dust be eliminated, and to accomplish this the silent chain-belt drive is employed so far as is practicable. In this connection a 5-horsepower, direct-current motor, with counter shaft and jack shaft, was replaced by two one-horsepower alternating-current motors with chain drive transmitting power to fans which operate in connection with drying ovens. This resulted in obviating grease spots and dirt which came from line shafts and leather belts.

In the main knitting mills all looping machines are operated in groups of 18 machines by one motor of ⅓ horsepower to each group. It is planned now to group 18 sewing machines together, to be operated by a 3-horsepower motor, the machines having a needle speed of 2800 strokes per minute. In the operation of these machines the transmission is by chain drive.

Energy for this installation is purchased from the central station of the Fort Wayne & Northern Indiana Traction Company.

Commutator Troubles on Foreign Boats.

BY M. J. MORIARTY.

American electricians have been troubled at times in repairing foreign commutators. The trouble has been caused chiefly by commutators insulated with asbestos composition or pasteboard, both absorbing moisture or oil. This trouble can be overcome by drying thoroughly, removing the imperfect insulation spots and filling the bad spots with mica or other reliable American repair insulation.

Among the Contractors.

The United States Government has awarded a contract to Harry Alexander, 20 West 34th Street, New York City, for electrical work at the Brooklyn navy yards at $8940.

Wright Electric Construction Company, Sixth and Main Streets, Fremont, Nebr., has received the contract for installing a lighting and water plant at Pender, Nebr., for $10,989.

The Carroll Electric Company, 714 Twelfth Street, N. W., Washington, D. C., has been awarded a contract for installing a fire-protection system at Anacostia, D. C., at a cost of $12,036.

A. F. Bell, Youngstown, Ohio, has received the contract for wiring 14 residences to be erected in that city at a cost of $52,500 by the Edbert Realty Company, of Cleveland and Youngstown.

The U. N. D. Electric Company, Akron, Ohio, has been awarded the contract for the electrical work in a new grade school costing about $125,000 to be built in Lovers' Lane by the Akron Board of Education.

The Baker-Dunbar-Allen Company, 1909 Euclid Avenue, Cleveland, Ohio, has received the contract for electrical wiring in a $50,000 salesroom and garage to be built for the Carris-Franklin Sales Company on Prospect Avenue near East 36th Street, Cleveland.

Leo H. Gamp, formerly in charge of the St. Louis office of the F. L. Newberry Electric Company, has left that company and organized the Gamp Electric Company to engage in general electrical construction business. His headquarters are 1625-26 Chemical Building, St. Louis, Mo. Mr. Gamp has for many years been associated with the electrical contracting business and is well known in St. Louis electrical circles.

QUESTIONS AND ANSWERS

All readers are invited to submit questions and answers to this department. Anonymous communications will not be considered. Questions should relate to electrical matters of any kind. Answers contributed by readers should be submitted preferably within eight days of the date of publication of the question and should be limited, if possible, to 300 words. Payment will be made for all answers published.

Questions.

No. 413.—Electric Room-Heat Regulator.—How does the system of electric thermostatic regulators for controlling the steam heat in rooms operate? I refer to such as are installed in some modern hotels. Is the control circuit of low voltage or 110 volts? How does the system compare with pneumatic regulator systems?—T. J. B., Duluth, Minn.

No. 418.—Small Low-Voltage Transformer.—In making up a small 200-watt transformer to be used on a 110-volt, 60-cycle, single-phase circuit, what size and shape of laminated core should be used, also what size and number of turns of wire is required for the primary and secondary windings to get 4 volts at the secondary terminals?—O. A. G., Minneapolis, Minn.

No. 419.—Undercutting Commutator Mica.—Admitting the advantages of undercut or slotted commutators, what factors determine whether or not a machine should have a slotted commutator?—S. T. N., Leadville, Colo.

Answers.

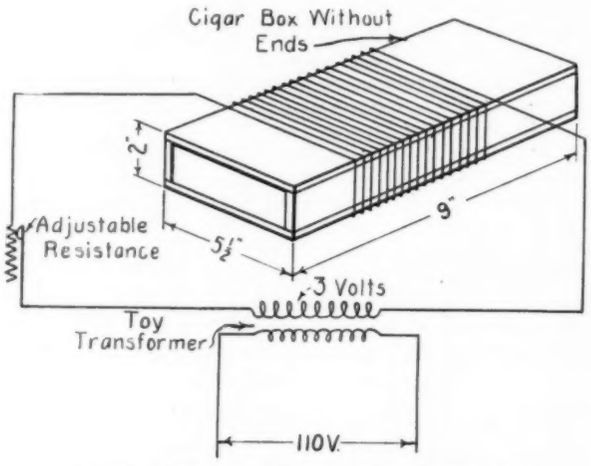
No. 412.—Submarine Radio Signal.—A dispute has arisen between two of my friends respecting the ability of a submarine to receive wireless messages when it is submerged; one man says it can and the other that it cannot receive messages under this condition. The matter has been referred to me and I would like authoritative statements to back up my decision.—H. S. C., Memphis, Tenn.

At the present time when our country is involved in war it is best for any man to say little or nothing of what he may know about the workings of various devices in use by our navy. I will, however, give a brief statement which probably will clear up this dispute. All submarine boats of the newer types are equipped with apparatus for both atmospheric and submarine radio signaling. It is well known that below the surface of the water the atmospheric system is useless owing to the fact that the antenna is completely short-circuited, therefore another means of signaling has to be resorted to. Water is a better conductor of sound than is air, water conducting sound waves at a rate of practically 4078 feet per second while air has a conductivity for sound of only about one-fourth of that of water. There is a device manufactured by a Boston concern, which is known as the Fessenden oscillator. This instrument will transmit and receive signals at distances from 25 to 35 miles. This oscillator consists of a vibrating diaphragm which is actuated by a high-frequency current and controlled by a suitable telegraph key, thereby permitting the use of any of the radio codes. When receiving signals the diaphragm is connected to the head telephone receivers and the operator receives similarly to the regular radio system. —W. F. P., Quincy, Mass.

No. 415.—Demagnetizing Coil.—I would like as complete information as possible about making a coil for demagnetizing by alternating current, especially the size of wire, the best shape of coil, how many turns to use, and how strong a current is required.—M. H. G., New York, N. Y.

Answer A.—The information given is not sufficient to answer the question completely. The size of steel to be demagnetized must be known. However, I have a coil for demagnetizing punch segments after they are held for grinding on a magnet chuck. The segments are of different sizes, the largest about 2 by 4 by ½ inch. I made a spool out of fish paper with an opening through the center so the largest segment could easily pass through (about 2¼ by ⅝ inch). I wound on this spool 1 pound of No. 29 B. S. gauge single-cotton-covered wire. This is connected across a 220-volt alternating-current circuit and the punchings are dropped through coil.—G. A. H., Youngstown, Ohio.

Answer B.—The accompanying diagram shows the outline of a simple coil that will answer the purpose of demagnetizing small objects, like watches, knives, etc.



No. 415.—Design for Simple Demagnetizing Coil.

It can be made using an old cigar box as the frame for the coil. Knock out the ends of the box. Wind on this about 150 feet of No. 14 rubber-covered wire. This will make 128 turns in four layers and cover 8 inches of winding space along the length of the box. Put in series with this coil an adjustable resistance or rheostat and connect the outfit across the 3-volt secondary of a small toy or bell-ringing transformer. Lay the watch in the box, close the circuit to the transformer and gradually cut in resistance on the rheostat until the current is reduced to an extremely low value. —H. E. W., Chicago, Ill.

No. 417.—Rewinding Induction Motor.—In rewinding a 50-horsepower, three-phase, 220-volt, squirrel-cage motor, will it make any change in the operation or efficiency to use two No. 13 double-cotton-covered wires in parallel in place of one No. 10 double-cotton-covered wire with which the motor is now wound?—H. L. M., Milwaukee, Wis.

Answer A.—No, it will not make any great difference in operation of the motor. The physical dimensions of No. 10 wire are not equal to two No. 13 wires, but for all practical purposes it can be used if the slot is sufficient in size for its use.—G. A. H., Youngstown, Ohio.

Answer B.—It will be found impossible to wind the coils with the No. 13 wire on account of the extra space occupied, unless the factor of insulation safety be reduced. Heating would be greater on account of the extra insulation possibly to such an extent as to damage the winding. The efficiency in any case would be lower. Exact figures cannot be given without further data.—H. E. W., Chicago, Ill.

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"LET THE CODE DECIDE."

WIRING FOR 2300-VOLT INSTALLATION.

Question 353.—In a 2300-volt installation is it permissible under the rules to install the conductors as (so-called) open work, supporting the conductors on insulators and protecting them against mechanical injury?

Answer 1 (O).—The matter of installing 2300-volt wiring for motor work is now covered under Rule 8, which requires ordinarily such wiring to be in lead-covered cable and in conduit. The next edition of the Code will require such construction for 2300-volt work for all purposes, except that open wiring properly installed may be allowed in central stations or substations, dynamo and motor rooms or transformer rooms.

Answer 2 (V).—Yes, if the wires are rubber-covered, kept 8 inches apart, and 1 inch from the surface wired over. Except motor wiring, as per Rule 8*b*.

Answer 3 (T).—Code Rule 8, section *b*, fourth paragraph, would permit open wiring on porcelain supports where special permission is obtained from inspection department having jurisdiction and motor and wiring is confined to and enters room provided for motors only.

Answer 4 (H).*—Rule 44 *b*, *c* and *d* applies to the general installation. I should, personally, prefer wires installed under this rule—with the high voltage noted—rather than in conduit or lead sheaths. The reference in Rule 44 to No. 8*b* refers, I think, more to the wiring of the motors themselves than the general installation.

Answer 5 (S).*—Rule 44 *c* and *d* provides for use of open-work knobs properly protected.

Answer 6 (E).—This question involves several possibilities which are frequently misunderstood. In our territory we have never been able to separate the requirements of Rule 8*b* when considering power installations in buildings other than central and substations and consequently have required the use of multiple-conductor, metal-sheathed cable in unlined metal conduit. In other than central or substation the requirements of Rule 44 could be applied in constant-current systems as provided in Rule 20, and only then when protected from all possible contact and mechanical injury. These constant-current systems are now so infrequently used, the writer feels that the installation of conductors on systems between 550 and 3500 volts should be confined to the requirements of No. 8*b* except when in central or substations.

Answer 7 (B).*—Rule 8, referring to motor installations (except in central or substations) operating at a potential between 550 and 3500 volts, requires an "approved multiple-conductor, metal-sheathed cable in approved metal conduit." This, of course, would preclude the installation of conductor on insulators insofar as this class of installation is concerned. Rule 44 relative to wires of high-potential systems (550 to 3500 volts) requires an approved rubber insulating covering. Wires must always be in plain sight and rigidly supported on glass or porcelain insulators, except as provided for in No. 8*b*, etc. This plainly permits of the installation of 2300-volt wires, so-called open work, properly protected against mechanical injury, except in the case of motors as covered by Rule 8 of the Code.

Answer 8 (K).—The Code permits this kind of an installation as prescribed in Rule 44. Local regulations would not allow it in this city. A state regulation would permit open wiring of that potential where conductors are isolated but would require that they be guarded by permanent inclosure if within 8 feet of the floor.

Answer 9 (R).—The method outlined seems to conform to Rule 44. In this territory the maximum potential allowed in any building, except substations, etc., is 750 volts.

Answer 10 (F and G).—Does this query refer to constant-current or constant-potential circuits? If constant-current circuits, Rule 20, National Electrical

The matter appearing in this section consists of questions on the National Electrical Code, its interpretation and meaning, and questions as to whether certain methods of wiring are in accord therewith. These questions are gladly received from anyone interested, even if not a member; they should be sent to the secretary with any needed elucidating sketch. They are answered by each member of the Executive Committee, according to his knowledge of what the ruling would be in his jurisdiction.

It should be understood that no pretense is made to give an authoritative interpretation of the Code. This is a voluntary association; it has representation on the Electrical Committee of the National Fire Protection Association, which prepares the Code, but it has no right, and claims no right, to give a final interpretation of anything in the Code. It is only intended to give the interpretation which seems correct to the members of the Executive Committee. No attempt is made to edit or correlate the answers from the different members of the Committee, as it is felt that the occasional difference of opinion is calculated to lead to a further study of the matter in question, further discussion and the final clearing up of obscure points.

The aim is to help toward a better understanding of the Code on the part of all; a more uniform conception of its meaning; increased precision in applying it; and harmonious action of those using it, for the common good.

Code, clearly defines the class of installation required. If constant-potential systems, Rule 44 and Rules 16, 17, 18 clearly define the class of construction required. Special attention is directed to Rule 8, section *b*, of the Code relative to motor installations operating at a potential in excess of 550 volts.

Answer 11 (P).*—Rule 44 prescribes the manner in which 2300-volt wiring may be installed on the open-work plan. This rule is qualified further by No. 8*b*, which prohibits open wiring for motors at this voltage. It should be remembered that the National Electrical Safety Code requirements will undoubtedly restrict further the cases where open work may be used for 2300-volt lighting mains.

Answer 12 (N).*—I should say yes, except in the case of motors.

FUSE PROTECTION FOR MOTOR KNIFE SWITCHES.

Question 354.—When installing knife switches for the control of motors, should each knife switch be protected by the fuses, or should the fuses be installed between the switches and the motor?

Answer 1 (O).—The position of a knife switch relative to the branch fuses for a motor is optional. The new requirements will require autostarters in all cases to be protected by a switch, although one switch may serve to disconnect current from several motors at once, if so desired.

Answer 2 (V).—It is not necessary to install the fuses to protect the motor on the source side of the starting switch if the switch is properly protected by fuses or circuit-breakers on the source side.

Answer 3 (K).—I should say that the switch should be installed so that same would be protected by the fuses and this would be the best practice to follow. However, the Code rules are not clear on this subject except in connection with service switches.

Answer 4 (H).—Rules 8*c* and 19*a* would indicate that the fuses must be on the service side of the switch; but, with a heavy load, I can see good reasons for having the fuse terminals absolutely dead when the fuses are changed, as will follow the installation of the fuses between the switch and motor.

Answer 5 (S).*—Rule 8*c* requires switches and cutouts. Rule 19*a* requires fuses to protect switches. We require combination fuses and switch in this city.

Answer 6 (E).—Knife switches, unless installed in cabinets, should be protected by fuses, no matter what the knife switch controls.

Answer 7 (B).*—The general custom is to install fuses on the service side of motor switch, protection thereby being afforded in case of any accidental short-circuit on the switch in question. The argument has been made (which argument, however, has not been recognized insofar as the rules are concerned) that, owing to the insertion of fuses by parties not thoroughly competent, the switch should be ahead of motor cutout so that cutout could be made dead while fuses were being inserted.

Answer 8 (K).—The switch should disconnect the fuses so that replacement can be made safely.

Answer 9 (R).—It is better practice to install the protection for the motor so as to protect the knife switch also, although this is not mandatory.

Answer 10 (F and G).—Switches, whether they be of the knife-blade type or other design, controlling motors, must, as required by Rule 19 section *a* of the Code, be so arranged that the fuses will protect and the opening of the switch will disconnect all wires of the circuit. Rule 8 section *c* further provides that an automatic circuit-breaker disconnecting all wires of the circuit may serve as switch and cutout. In case of a motor equipment placed within a risk and the motor installation constituting the entire equipment within the risk, the service switch and cutout being readily accessible and within plain sight of the motor, and the service switch being used as the controlling switch for the motor installation, if installed in accordance with Rule 23 section *a*, second paragraph, the cutout need not protect the switch.

Answer 11 (P).*—The Code does not say. The only rule stating the order of precedence of fuse and switch is contained in No. 23*a*, second paragraph.

Answer 12 (N).*—I think this switch (branch motor switch) should disconnect the motor fuses so they may be replaced with security. Of course, if it is the only switch on the installation it would be very probable that the fuses would come under the head of service fuses. In that case I would like to see *smaller* fuses on the motor side of switch.

VARNISHED-CAMBRIC CABLES FOR LARGE FEEDERS.

Question 355.—For large sized feeders permission is frequently asked for the installation of conductors having varnished-cambric insulation. Do our members grant such permission? If so, under what conditions is such permission granted?

Answer 1 (O).—Varnished-cambric insulation is not recognized as a National Electrical Code standard material and should not be approved within buildings. In this jurisdiction it is sometimes used by taking the conduits underground, where they would not be considered in the building, and would not be covered by Code requirements.

Answer 2 (V).—I would approve of it for work in dry places.

Answer 3 (T).—We have had no experience with installations of conductors having a varnished-cambric insulation, therefore can give no advice on this subject.

Answer 4 (H).*—The type of construction to which you refer is very seldom used in this jurisdiction. We have, on certain occasions, allowed varnished-cambric insulation where the wire is run in an absolutely dry place.

Answer 5 (S).*—By special permission in the district of the N. E. I. Exchange, Boston office, varnished cambric is allowed.

Answer 6 (E).—Our department does not hesitate to grant permission for the installation of conductors having varnished-cambric insulation under the ratings of Table 18*B*, the only condition being that such cables will not be installed in damp places.

Answer 7 (B).*—The matter of varnished-cambric insulation in connection with conductors is not specifically covered in the Code. In this territory its use is allowed, however, where permission is asked, and where it is installed under the rules and requirements relating to so-called rubber-insulated conductors.

Answer 8 (K).—Permission has been given on several installations, but in all cases the varnished-cambric insulation has been incased in a lead sheath or armor.

Answer 9 (R).*—Yes, such permission has been granted in this section, the only condition being that absolute dryness is assured.

Answer 10 (F and G).—We have granted permission for the use of varnished-cambric cable under the same conditions as required for rubber-covered conductors. This permission has only been granted for use in large feeders, lead-incased, installed open or in conduit, as circumstances warrant.

New Appliances

New Transformer—Vacuum-Cleaner Receptacle—Tire Pump—Drill and Grinder—Howell Motor—Rimco Plier

Convenient Series-Transformer Connections for Street-Lighting Circuits.

In towns where construction men are not familiar with "wiped" joints on lead-covered cables for ornamental lighting circuits a new current transformer, for series circuits, with a union joint is a great convenience. With the new transformer it is not necessary to "wipe" the joints inclosing the gap between

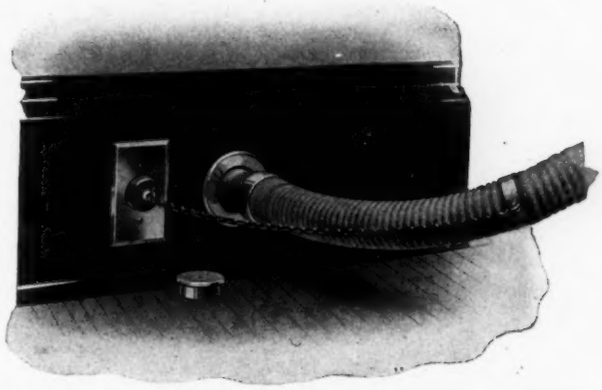
Series Lighting Transformer With Union Joint.

the lead sheath of the underground cable and the sleeves surrounding the cable going from the transformer. This device is provided with a strong union joint which, when screwed up tight, is entirely waterproof. It is manufactured by the General Electric Company, Schenectady, N. Y.

Automatic Control for Stationary Vacuum Cleaner with Flush Receptacle.

Stationary vacuum cleaners when installed in large apartment buildings, hotels, club houses and halls, have hose connections in many locations and switches on each floor to start and stop the cleaner. With such a system, an employer or tenant using a cleaner connection on one floor and knowing that others are being used elsewhere on the system depends on them to close down with the usual result that the plant continues to run and with the resultant waste of current.

To overcome these objections, the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has designed a vacuum-cleaner receptacle, the cap of which is attached to the hose, as shown in the accompanying illustration. Inserting the cap in the receptacle closes an auxiliary circuit to the starting equipment. In the case of small stationary outfits in private homes, the cap can be used to close the motor circuit direct. This automatic control insures against waste of current and unnecessary operation of the cleaner. These receptacles are wired in parallel so that the insertion of



C-H Vacuum-Cleaner Receptacle for Stationary Vacuum-Cleaner Plants.

one or more caps will operate the plant. Being chained to the hose the cap will always be handy when the use of the hose is required. The receptacle and cap furnished are of a special design, which permits the cap to be readily detached at any angle. Being of special design, no other cap is interchangeable and consequently the receptacle cannot be used for other purposes. The complete device includes receptacle, cap and 14 inches of chain, but not the hose clamp.

A Portable Electrically Operated Tire Pump.

The Black & Decker Manufacturing Company, Baltimore, Md., has developed a hand portable, motor-operated, air compressor (and tire pump) called the Lectroflater. It is intended for private use, and also for the use of garages, automobile-accessory stores, and tire shops. The Lectroflater is of unit construction—that is, the gear box and high-pressure air compressor are incased in one housing.

The motors are made by the General Electric Company and whether for use on 32, 110 or 220 volts, can be used on either alternating-current or direct-current circuits, connection being made by cord and plug to convenient incandescent lamp socket. The motor is geared to the pump, which is of the piston type with

Readily Portable Electric Tire Pump.

a 2-inch stroke and capable of developing a pressure of 150 pounds. The compressor is automatically cooled and lubricated and the air passes through an expansion chamber, which removes moisture.

The operating cost based on an 8-cent per kilowatt-hour rate is 2¾ cents per hour for uninterrupted service. From this it works out that the average cost of inflating a tire is about 0.11 of 1 cent, as the time required to pump a 34 by 4-inch tire from dead flat to 70 pounds pressure is 1¾ minutes.

Versatile Motion-Picture Star Invents a New Cooper Hewitt Photographic Lighting Unit.

Benjamin Chapin, the well known motion-picture star, was dissatisfied with any lights that he could purchase for getting certain effects "close up" so he evolved a novel combination which gives perfect lighting in taking a close-up set or group.

Calling his technical director and chief electrician to his office he outlined his invention and instructed them to make the new bank at once out of various parts of late model of Cooper Hewitt banks which were installed in his studio.

When interviewed by General Sales Agent Hubbard, of the Cooper Hewitt Electric Company, Mr. Chapin explained the influences that led him to invent the new unit. "As you doubtless know," he said, "the character of Abraham Lincoln, which I portray in the Lincoln Cycle, is a very difficult subject to photograph for various reasons. In the first place, Lincoln wore a black suit and with the dark beard it does not offer much contrast photographically. I found it particularly difficult to arrange the lights, as we are using both the ordinary side banks and the combination side and overhead. In numerous tests I noticed that the black beard was hard to be distinguished from the black coat that I wear. I figured that if I could get sufficient light from underneath, it would act as a back light and throw the dark outlines into relief. When the combination bank was made and tested it proved to be just as I anticipated and gave wonderful results, which can be especially noticed in our recent 'close ups.' The effect is a soft natural tone which we could not get in the glare of carbon lamps generally used in these close-up scenes."

The Cooper Hewitt Company realizes the big advantages of Mr. Chapin's novel invention and will add it to its line of banks, so that in the near future other picture producers will find a difficult phase of lighting solved through Mr. Chapin's ingenuity.

Portable Electric Drills and Grinders.

At this time when working in metal and wood are synonymous with carrying on the war, any labor-saving device which can be employed should be put to work at once. Portable electric tools by replacing hand operation save time and labor and increase the output of a given working space. Particularly is this true of a portable electric drill, such as that shown in the illustration. Less "elbow room" is required by a working man using one of these devices, and since he can drill a great many more holes per hour, he can replace a number of men who may be given to other tasks. This drill, which is manufactured by the Gilfillan Brothers Smelting & Refining Company, Los Angeles, Cal., is equipped with gears to give two speeds. These are changed by means of a knob on the bottom of the gear case. The gears themselves are made of chrome-nickel-steel and run in grease. Ball bearings are used throughout. A ½-inch standard chuck and a sturdy electric switch are provided. The speed range is 400 revolutions per minute on low

Portable Electric Drill.

speed and 700 on high speed. Westinghouse motors are furnished.

The same concern also manufactures a tool-post grinder adapted for use of lathes. An angle plate can be clamped around the tool post. Vertical adjustment of the grinder is provided for. This grinder is equipped with a Westinghouse one-quarter-horsepower motor running at 3400 revolutions per minute. It is provided with a 6 by ⅜-inch grinding wheel, an exten-

Motor-Driven Tool-Post Grinder.

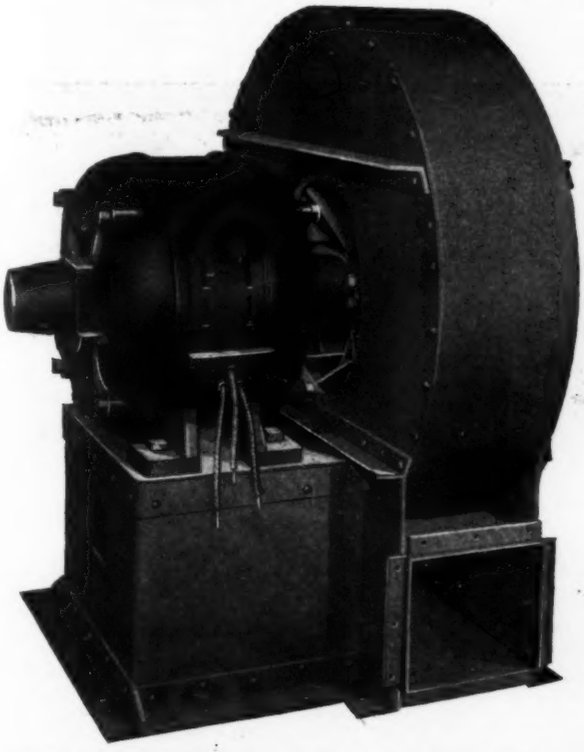
sion mandrel for internal grinding fitted with a 1½ by ⅜-inch wheel, a tool rest for cutter grinding and an electric attachment plug with 7½ feet of cord.

Howell Electric Motors—Their Manufacture, Characteristics and Testing.

The Howell Electric Motors Company, Howell, Mich., which is a comparatively new concern, has a well equipped shop, arranged solely for the manufacture of electric motors. The principal shop, occupying a ground space of 60 by 220 feet, is so equipped as to permit the handling of material advantageously through the several consecutive processes by means of

monorail trolley and hoist equipment. In this there is no lost motion, because every move is steadily along the logical course toward the place where the finished product is turned out. About 2000 Howell motors have been sold and installed in the various lines of industry, and the shops are very busy on orders in hand.

The Howell induction motors are constructed after designs by Prof. Benjamin F. Bailey, head of the electrical engineering department of the University of Michigan, Ann Arbor. They are built in sizes from ½ horsepower up to 100 horsepower, for operating at pressures of 110, 220, 440 and 550 volts, two-phase and three-phase circuits, and at all standard speeds. Motors of 7½ horsepower and less require no starting compensators, but those of 7½ horsepower and above it are supplied with manually operated compensators. The plan of the company is to specialize on polyphase



Howell 3-Horsepower, 600-R. P. M., Induction Motor Direct-Connected to Blower.

induction motors, allowing close and undivided supervision in the manufacture.

The type B motor, comprising all capacities up to 30 horsepower, is built of laminations of sheet steel, riveted under high pressure between cast-iron end frames, allowing the requisite number of ventilating ducts between the laminations and end frames, to permit the escape of heated air from the interior.

Special stress is placed on the character of the bearings. These are unusually large, and the bushings of phosphor bronze are the company's two-piece, rotor-centering oil-ring type, permitting the oil to be carried from the center along the bearing surfaces by spiral grooves cut in the face of the bushing. Attention is called to the fact that, especially as to motors which are belt-connected to the machines they drive, the bearing wear is mostly on one side, and when the bearing wears away on that side the air gap between the stator and the rotor is eliminated and rubbing of the surfaces results with destructive effects. In the Howell design of bearing, the outer bushing may be rotated half way around, bringing the unworn part of the bushing to bear where the tension and wear are exerted.

In the construction of type A motors, ranging from 30 to 100 horsepower, a skeleton-cored frame is adopted, the steel laminations being bolted together under hydraulic pressure between end frames, with provision for ventilating ducts in a manner nearly similar to that of the B type, only that the end frames have five projecting lugs which serve as bolt holes and locating lugs, and which enter into the cored cross ribs of the skeleton frame, holding the stator in the skeleton frame. The stator is held laterally on each side by keys seated in the inside face of the skeleton frame, allowing the stator to be built up and wound and treated separately from the frame, which permits quick repair or replacement of the stator.

The Howell motors are made for back-gear and idler-pulley attachments. The high-torque motors, slip-ring and star-delta connected motors of the Howell type are fully described in the company's literature.

On the testing floor of the Howell shop the tests comprise those for all no-load readings, full-load readings, resistance in each phase, the locked-motor readings for torque developed, a 2200-volt test between windings and frame. Each motor is carefully inspected for bearings, noise, balance, air gap, end play and oil leaks. In practice, all test sheets are signed by the tester and approved by the engineer. C. F. Norton, vice-president and general manager of the Howell Electric Motors Company, is a man highly trained in electrical work. Henry Spencer is president of the company.

Rimco Rubber-Insulated Pliers.

The lineman who is compelled to work on live lines must use thoroughly insulated pliers to safeguard himself from violent shock. This protection has been recognized many years and many attempts at insulating the plier handles have been made. As a rule such handles are covered with either some hard-rubber compound or a semi-soft-rubber tube that can be slipped on. The objection to the hard rubber is that it is liable to crack or break when the pliers are given some hard knock, such as by being dropped from a pole to a hard pavement or rock ground. The slip-on insulation is not durable, either in the mechanical or dielectric sense, and therefore is likewise undependable.

These objections are overcome by a special rubber insulation applied to the handles by a new process. This is known as the "Elchemo Process" and is protected by American and foreign patents. It makes a perfect and permanent bond between the metal of the handle and the insulating compound, and insures reliable insulation of the handles under the hard service that linemen subject pliers and other tools to. This insulation does not crack or chip under rough usage. The handle is shaped for comfortable use.

These pliers are known as "Rimco" rubber-insulated pliers and are made by the Rubber Insulated Metals Corporation, Plainfield, N. J. Every pair is subjected to severe tests at the factory and then is further tested at 10,000 volts by the Electrical Testing Laboratories, New York City. A tag is affixed to each tool, giving the date of this dielectric test and the guarantee of the manufacturer.

Trade Activities

Hurley Machine Stock Offered—Benjamin Electric Employees Meet—Novel Shipping Method of Westinghouse Transformer

Century Electric Company, with general offices at 1827 Pine street, St. Louis, Mo., announces the appointment of Lyman C. Reed, 821 Union street, New Orleans, La., as district sales agent for Century alternating current motors and fans. A complete stock of both motors and fans will be carried in stock by Mr. Reed, and all inquiries and orders will receive his prompt attention.

The Eastern Malleable Iron Company, Naugatuck, Conn., with office and works at Union City, Conn., in its Catalog No. 3, which supersedes all previous issues, describes and illustrates its Beardsley's patent malleable iron high-tension insulator pins, brackets, and break arms for electric railway, electric lighting, telegraph and telephone service. This little booklet contains much valuable data on these products.

The Cutter Company, Philadelphia, Pa., is sending out its new wall calendar covering the year from February, 1918, to February, 1919. As customary, the illustrations are devoted to the many types of I-T-E circuit-breakers, for the production of which the company is so well known. Among the special types shown are the following: A remote-controlled, motor-operated switch for a 4000-kilowatt, three-phase generator; a 20,000-ampere, 750-volt breaker; a circuit-breaker for protection of three-wire generators; a 15,000-ampere, single-pole breaker; motor-operated starting and running switch for a 2000-kilowatt booster rotary; a motor-operated, 25,000-ampere, overload breaker; a double-pole, double-throw, motor-operated, 12,000-ampere, 250-volt breaker; a 10,000-ampere, 600-volt double-pole, plain overload breaker. Each illustration is accompanied by suitable explanatory matter.

The Hurley Machine Company, Chicago, manufacturer of the Thor electric washing machine, the Thor electric vacuum cleaner and the Thor electric ironing machine, through John Burnham & Company, 41 South La Salle street, Chicago, is offering $500,000 7 per cent cumulative preferred stock at a par value of $100 per share. In a circular issued by Neil C. Hurley, president of the Hurley Machine Company, and John Burnham & Company, Chicago, the capitalization, history, business, etc., of the company is explained. Because of its growing business the company has purchased a larger plant, located at Twenty-second street and Fifty-fourth avenue, Cicero, just outside of the city limits of Chicago. This has 250 feet frontage by 636 feet, with buildings containing 65,000 square feet of floor space. New manufacturing buildings and an office building have been added, and a large amount of additional equipment is being installed. When completed the plant will have a total of 134,181 square feet of floor space, or over three acres, and a full equipment of the most modern machinery. The company was incorporated under the laws of Illinois in 1906, and its steady growth in annual sales for the last six years, ending December 31, are as follows:

1912	$ 394,722.28
1913	435,929.77
1914	460,408.38
1915	631,007.81
1916	1,061,589.80
1917 (December partly estimated)	1,680,000.00

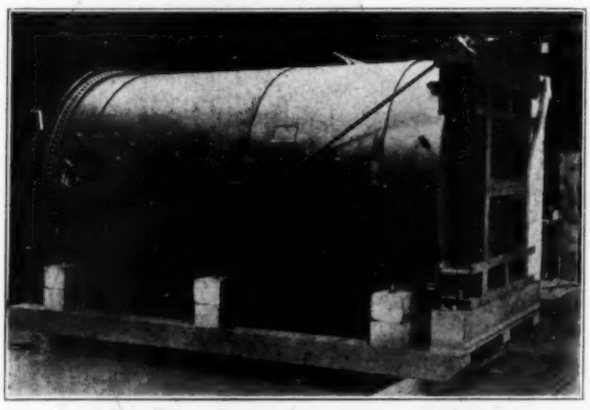
The net profits for these years have been as follows:

1912	$ 61,402.03
1913	66,824.01
1914	28,871.07
1915	81,800.01
1916	189,213.52
1917 (December partly estimated)	300,000.00

The entire proceeds from the sale of this issue of preferred stock will be used in the business, and besides placing the company in a very strong financial position will provide ample working capital to care for the rapidly increasing trade.

The Argus Lamp & Appliance Company, 322 Euclid avenue, Cleveland, Ohio, is distributing a bulletin on its Argus units, consisting of the Sheck Universal Adapter and Argus Current Regulators for operating all types of Mazda projector lamps for motion picture projection. The sales information and prices contained in this bulletin became effective February 1 and supersedes all previous prices.

Westinghouse Electric & Manufacturing Company, in shipping from East Pittsburgh three 7500-kilovolt-ampere water-cooled transformers for the Northern States Power Company, St. Paul, Minn., a Byllesby Company property,



Large Westinghouse Transformer in Special Cradle Ready for Shipment.

used a novel method of skidding and packing the transformers. The weight of the transformer without oil is approximately 45,000 pounds. The transformer has been built up to a circular shape to fit the tank. The cooling coils were left fastened to the transformer cover and a bracing arrangement through the center of these coils against the top of the cover, which was in turn braced against the end of the car, served to hold the transformer in place inside the tank. These transformers were so large that, even when loaded on a Westinghouse drop-frame car, if shipped in the upright position, they would barely be within the maximum height allowable by railroad bridges, etc., by placing a special flat cover on the tank. It was found by the Engineering and Construction Department of H. M. Byllesby & Company that if the transformers were to be shipped in this manner there would be difficulty in getting the transformers over the street at destination and up a rise of about 30 feet without crushing through the streets or tipping over. They therefore suggested that the transformers be shipped lying on their sides, if possible. The Westinghouse Company has an ingenious cradle in which to place transformers when they are to be turned over on their sides. The cradle consists of a platform with one side projecting up at right angles to the floor of the platform. At the corner of this platform there is a rocker. Attached to the top of the side and to the outer edge of the platform are chains of equal length, which, after the transformer is placed on the platform, are attached to a crane. The crane starts lifting and the chain attached to the platform is, of course, the one that carries the weight. This starts to tip the cradle on the rocker and when the cradle is just half tipped both chains are bearing the weight. As the transformer goes on over in the cradle the chain attached to the top of the side, of course, bears the weight, and the one attached to the platform is slack. By this means there is no rough jostling at all in tipping the transformer.

Chambersburg & Shippensburg Traction Company, Chambersburg, Pa., held its annual meeting of stockholders on January 24, at which the following officers were elected: J. A. Strite, president; A. Nevin Pomeroy, vice-president. George B. Beaver, and Frank Stouffer, of Waynesboro, were elected on the board of directors.

Domestic Engineering Company, Dayton, Ohio, has been authorized to increase its capital stock from $800,000 to $3,500,000. This company is the manufacturer of the Delco farm-lighting plant, which has had such extensive sales in the past year throughout the country as to convince the management that this product meets the requirements of such equipment in an exceptionally satisfactory manner. The increased capital will permit a great expansion in the business of the company.

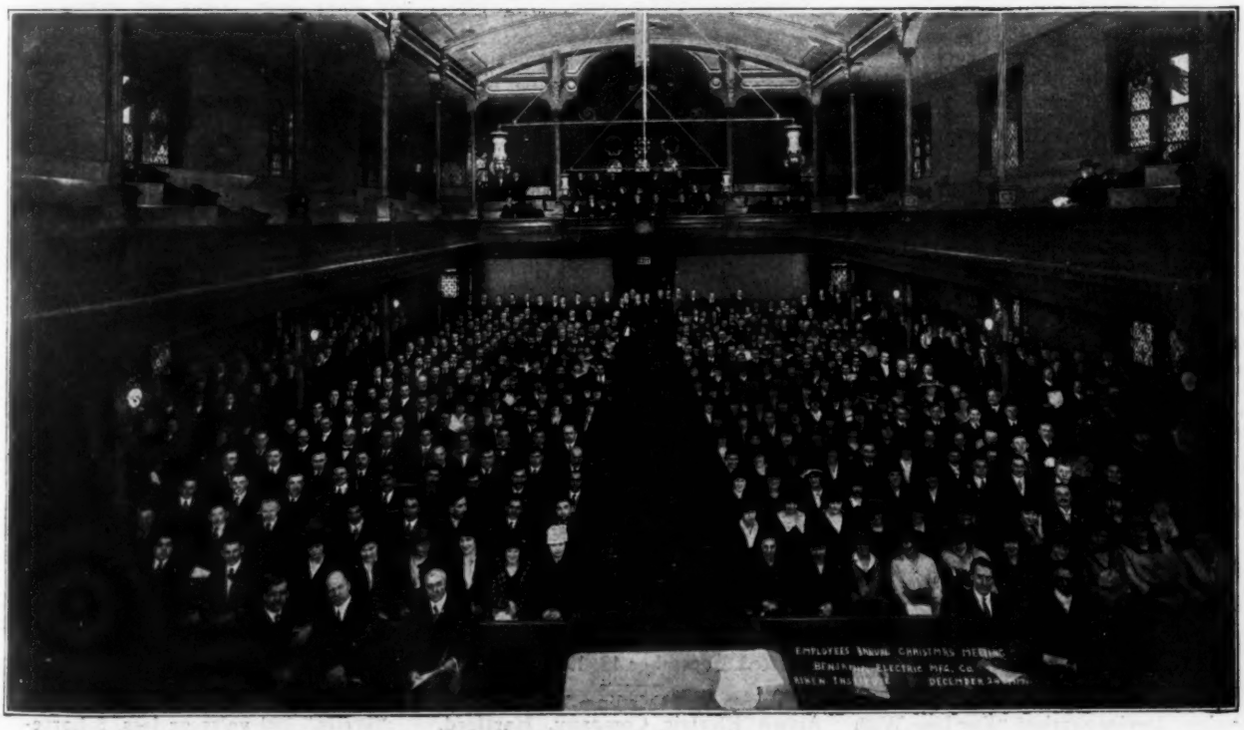
Benjamin Electric Manufacturing Company held its annual pre-holiday meeting on December 24, 1917, at the Aiken Institute, Chicago. This meeting day has, for several years, been sort of a holiday, and, in fact, the only day in the year when all Benjamin employes have been able to visualize what the Benjamin organization meant. Over 500 persons attended the meeting, the size of which is shown by the illustration. The remembrances to each employee were based on a Christmas present of $5.00, plus $1.00 for each year the employee had been in the service of the Company. A few were present who received $20 in their envelopes, which marks the extreme length of service, for the Benjamin Company is little over 15 years old. An interesting program was staged, with music and speaking. R. B. Benjamin, president, for the first time in the history of the organization, was prevailed upon to make a public address. In that straightforward, simple, direct manner characteristic of the man, Mr. Benjamin gave to the organization the story of the early struggles in the years before there was a Benjamin institution. From "basement to Benjamin Electric" express the theme of an interesting talk in a real family party. W. D. Steel, vice-president and general manager, also addressed the employees, forecasting the possibilities for our organization and outlining the increased opportunities for individual effort in the future. It was a practical meeting, one that would help to develop thoughtful and earnest effort for another year. It is a part of the work which the Benjamin Company is doing to sell the institutional idea to its own employees. At least once a year this company gathers the members of its force all together for the purpose of instilling into each mind the purposes, the will and the spirit of the house. For months after that there is bound to be a greater co-ordination of effort in the organization.

Evans & Barnhill, Inc., 7 East 42nd street, New York City, announce their recent incorporation to conduct a merchandising-advertising business. David G. Evans and J. D. Barnill, who are partners in this new firm, have combined their efforts in the interest of those whom they have served in the past and it is believed that through this arrangement profitable rewards are promised to all parties concerned.

Electrical Engineers Equipment Company, of Chicago, announces the removal of its general offices and a portion of its manufacturing departments to 710-714 West Madison street. This new location is directly opposite the company's present quarters at 711-715 West Meridan street. The major portion of the factory proper together with the shipping and stock departments will remain at this latter address, which is connected to the Madison street building by means of a runway. All mail should be addressed to 710-714 West Madison street, and all supplies to 711-715 West Meridian street.

The Harvey-Campbell Aircraft Company has been organized with offices and plant at 914 First Avenue South, Seattle, Wash., with the following members: F. H. Osgood, president; Carl G. Harvey, vice-president and manager; R. H. Parsons, treasurer; Kenneth Campbell, secretary. Frank Waterhouse, Louis Hedrick, Moritz Thomsen, W. H. Bogle and others are stockholders. The work of assembling and manufacturing aircraft is under way from patents of Earl G. Harvey, who has had many years' experience in perfecting aircraft motors and designs. Fifteen men are employed at present.

Link-Belt Company, with principal offices in Chicago, Indianapolis and Philadelphia, and branch offices in all the main cities of the United States, is sending out booklets Nos. 54 and 356. The first booklet describes and illustrates the gravel-washing and sand-drying plant of the Absecon Sand Company at Absecon, N. J. This modern plant is equipped with Link-Belt elevators, conveying installation, etc., and, on request, the Link-Belt Company will supply its Book 213, giving engineering advice in designing and building equipment for handling sand and gravel and all kinds of material. Booklet 356 deals with Link-Belt sanitary peeling tables for the modern canning factory. The Link-Belt conveyor described and illustrated systematizes and regulates the peeling by keeping the peelers supplied with tomatoes, etc., removing the buckets filled with vegetables and fruits, as well as the empty buckets and cans. A page in the booklet gives a partial list of users of the Link-Belt peeling table, also the number of tables in use by each company.



Meeting of Employes of Benjamin Electric Manufacturing Company at Chicago.

Latest Approved Fittings

The electrical fittings listed and described in this department have been approved by the Underwriters' Laboratories, Incorporated, after examination and tests conducted under standards of the National Electrical Code as recommended by the National Fire Protection Association.

Cleaning Machines—Suction Cleaners. — National Sweeper Company, Torrington, Conn.

"Torrington" and "Aladdin" portable motor-driven suction cleaning machines. 1.2 amperes, 110-125 volts, alternating current and direct current.

Listed December 13, 1917.

Conduit Boxes.—Russell & Stoll Company, 17-27 Vanderwater Street, New York, N. Y.

Cast-iron and cast-brass conduit boxes, catalog Nos. 432, 481, 1432, 1481.

Listed November 28, 1917.

Fixtures, Vaporproof.—H. T. Paiste Company, 32nd and Arch Streets, Philadelphia, Pa.

Types VLA, VLB, VLC, VLL, VLT, VLV, VLX, VLGA.

Listed December 29, 1917.

Fuses, Cartridge.—Greef Engineering & Manufacturing Company, 36-38 Spring Street, Newark, N. J.

Four-in-One "Atlas." Cartridge inclosed fuses having four elements, any one of which can be connected in circuit by twisting ferrule or blades. 0-100 amperes, 250 volts.

Listed November 15, 1917.

Heaters, Miscellaneous—Bath Cabinets.—Burdick Cabinet Company, Milton, Wis.

Metal cabinet provided with doors at top and front. The interior is lined with reflecting material and is equipped with receptacles for incandescent lamps arranged in circuits and controlled by switches and cutouts placed on outside of cabinets. Special terminal is provided for ground wire. Designed for medical heat and light-bath treatment of persons. 3000 watts or less, 125 volts, type E.

Listed December 10, 1917.

Lightning Rods.—Burkett Lightning Rod Company, Fremont, Ohio.

Listed December 5, 1917.

Outlet Bushings and Fittings.—S. R. Fralick & Company, 15-17 South Clinton street, Chicago, Ill.

"Kwikon" cast-iron couplings in straight and angle styles for use with armored cable and flexible conduit.

Bushings and locknuts for rigid conduit. Standard pipe sizes.

Listed December 4, 1917.

Picture Machines, Stereopticon Type.—Grinnell Advertising Machine Company, Grinnell, Iowa.

"Advertograph." Solenoid-operated automatic device using 400-watt incandescent lamp and inclosed in sheet-metal case. Designed for projecting advertising matter printed on a circular slow-burning film inclosed in machine. 660 watts or less, 115 volts. Device marked "For Use With Slow-Burning Film Only."

Listed December 13, 1917.

Receptacles for Attachment Plugs, and Plugs. — The Cutler-Hammer Manufacturing Company, Milwaukee, Wis.

"C-H," 660 watts, 250 volts, plug only, catalog No. 7702; receptacle only, catalog Nos. 7727, 7760, 7763, 7766; receptacles and plugs, catalog Nos. 7728, 7761, 7764, 7767.

Listed December 5, 1917.

Receptacles for Attachment Plugs, and Plugs.—Harvey Hubbell, Inc., Bridgeport, Conn.

"Hubbell," 10 amperes, 250 volts, catalog No. 6618.

Listed December 7, 1917.

Receptacles, Medium-Base. — Trenton Electric & Conduit Company, Trenton, N. J.

"T. E. & C. Co." porcelain shell. Keyless, catalog No. 183.

Listed Nov. 27, 1917.

Receptacles, Medium-Base. — The Arrow Electric Company, Hartford, Conn.

"Arrow E" metal shell.

Key, catalog Nos. A-20, A-23, A-59, F-19 to F-36, inclusive, F-59, FA-220, FA-229, FA-231, FA-259, FF-219 to FF-236 inclusive, FF-259, 9186, 60018.

660 watts, 250 watts, catalog Nos. 7530 W, 8030 W, 8058 W, 8090 W.

Pull, catalog Nos. D-20, D-59, E-19 to E-36 inclusive, E-59, FD-220, FD-259, FE-219 to FE-236 inclusive, FE-259, FI-219 to FI-236 inclusive, FI-259, FJ-219 to FJ-236 inclusive, FJ-259, I-19 to I-36 inclusive, I-59, J-19 to J-36 inclusive, J-59, 108.

Listed November 22, 1917.

Keyless, catalog Nos. C-20, C-59, FC-220, FC-259, FH-219 to FH-236 inclusive, FH-259, H-19 to H-36 inclusive, H-59, 50717-18, 60019-20.

Cleat-rosette receptacles for link fuses, for use only in large mills in accordance with Rule 23*d*, National Electrical Code, 2 amperes, 125 volts, catalog Nos. E-38, F-38, FE-238, FF-238, FH-238, FI-238, FJ-238, H-38, I-38, J-38.

Listed November 24, 1917.

Receptacles, Medium-Base.—General Electric Company, Schenectady, N. Y.

"G. E." porcelain shell.

Keyless, catalog No. GE-968.

Listed December 12, 1917.

Receptacles, Medium-Base. — The Arrow Electric Company, Hartford, Conn.

"Arrow E" porcelain shell.

Key, catalog Nos. PA-920, PV-920.

Keyless, catalog Nos. PC-920, PW-919, PW-920, PW-922, PW-928, PW-929, PW-932, PW-935, PW-957, 4109, 8105-08 inclusive, 8117.

Pull, catalog Nos. PD-920, PX-919, PX-920, PX-922, PX-928, PX-929, PX-932, PX-935, PX-957.

Weatherproof porcelain receptacles. Keyless, catalog No. 62358.

Listed November 23, 1917.

Resistance Appliances. — Monitor Controller Company, Frederick and Lombard Streets, Baltimore, Md.

Automatic starting rheostats, ¼ to 150 horsepower, 500 volts, or less. Type Nos. 105, 106, 240, 245, 345, 410, 415, 441, 564, 590, 600, 605, 715, 1101, 1110, 1116, 1120, 1355, 1365, 1380, 1385, 1440, 1441, 1515, 1575, 1580, 1585, 1840, 1845, 1850, 1855, 1860, 1865.

Listed December 14, 1917.

Sockets, Medium-Base. — General Electric Company, Schenectady, N. Y.

"G. E." metal shell.

Key, catalog Nos. GE895, GE902, GE904, GE978-80 inclusive, GE992, GE995.

Keyless, catalog Nos. GE048, GE896, GE903, GE905, GE981-83 inclusive, GE993, GE998.

Pull, catalog Nos. GE975-77 inclusive, GE994.

Listed November 21, 1917.

Switch Boxes.—H. T. Paiste Company, 32nd and Arch Streets, Philadelphia, Pa.

"Pipe Taplets." Cast-iron single and gang type boxes for mounting switches and attachment-plug receptacles.

Rigid conduit pattern, types FS, FSC.

Listed December 13, 1917.

Switches, Inclosed.—The Crouse-Hinds Company, Syracuse, N. Y.

Three-pole motor-starting knife switch with clips of standard cartridge inclosed fuses which are short-circuited when switch is in starting position. Inclosed in metal case and designed for manual operation without opening case.

"C. H. Co.," 30 and 60 amperes, 250 volts, 30 amperes, 500 volts, alternating current, types MF, MFA, MFB, MFC, MFD, MFE.

Listed December 13, 1917.

Switches, Inclosed. — Wells-Morris Manufacturing Company, 90 Second Street, San Francisco, Cal.

Automatic switch, consisting of laminated brush contacts, spring and gravity-opened; retained in closed position by no-voltage release solenoid lock; standard time-element plugs provided to afford protection to motor against overloads maintained for longer than predetermined periods. Inclosed in metal case and designed for manual operation without opening case.

"Wells," 250 volts or less, 5 horsepower or less, types B. C.

Listed January 2, 1918.

Men in Service

Clayton W. Pike Commissioned Major—E. C. Higgins to Instruct Men in Signal Corps—Other Promotions

R. L. HALL of the office of General Manager T. W. Carroll, of the Western Union Telegraph Company at New York, has been commissioned first lieutenant in the Signal Corps and expects to sail for France in the near future.

CAPT. ROBERT B. OWEN, secretary of the Franklin Institute, Philadelphia, and widely known in electrical engineering circles, has been promoted from captain to the rank of major of the United States Signal Corps, and is now with General Pershing at the front in France.

W. R. DAVIS, chief engineer of Station A of the Springfield Gas & Electric Company, Springfield, Ill., has been granted a leave of absence from his post, to become chief instructor of the Naval Radio Service Training School at Dunwoody Institute, Minneapolis, Minn.

ELECTRIC CLUB-JOVIAN LEAGUE of Chicago now has the following members in military service: Bion J. Arnold, A. D. Bernstein, Carl F. Brown, H. M. Byllesby, J. J. Carrick, Otis B. Duncan, W. L. Geuder, W. A. Haglund, William E. Hann, W. Y. Hendron, P. Junkersfeld, C. H. Kinney, Robert T. Purchas, W. S. Taussig, S. R. Todd and W. S. Vivian.

B. J. Ross, JR., formerly in charge of the semi-finished material stockroom at the Marconi Wireless Telegraph Company's factory at Aldene, N. J., enlisted and enrolled in the United States Naval Reserve Force recently. He has been assigned to special duty in the District Communication Bureau. Mr. Ross is the son of B. J. Ross, manager of the Western Union Telegraph Company at Cleveland, Ohio.

NORTHWESTERN ELECTRIC EQUIPMENT COMPANY, with executive offices and main warehouse at St. Paul, and warehouse and district sales office at Duluth, Minn., in the February issue of the Northwestern Buzzer lists the names of 12 employees on its roll of honor and their connections in military service. One of the number, G. C. Rosness, who served as an electrician in the United States Navy, died while in active service on November 21, 1917.

DUQUESNE LIGHT COMPANY section of the National Electric Light Association, has added the following names to its roll of honor since the publication of the November issue of the Light Company News: John F. Altvater, Peter Bolo, Charles Dietz, Thomas Dunn, Nelson Forbes, Calvin H. Giles, Granville Grogan, Hobart Hupp, John J. Joyce, Vernon B. King, Hugh Logue, G. D. McKinney, John F. McAteer, Verner Neelan, John Onorato, Eustace Paquet, Carl C. Ramsey, Sidney Small, James A. Somers, Samuel Tecco, James J. Talbot, Nick Veneziale, Frank C. Wycoff and Benjamin Wallace. The company up to January 1 lists the names of 143 employees in various branches of government service.

ROLL OF HONOR.

The electrical industry, perhaps to a greater extent than any other industry, has answered the call of the Nation for Men. As this is a war of engineers, naturally the technically trained men in the electrical industry have been in great demand and they have responded with splendid patriotism. Many of the large utility and industrial corporations have assigned men for Government service aside from those who have voluntarily entered or been called for service.

THE ELECTRICAL REVIEW *will welcome news concerning men who have entered the service or who are engaged in any patriotic duties.*

AMERICAN TELEPHONE & TELEGRAPH COMPANY'S service flag now contains 7,260 blue stars, representing that many of its employees in military and naval service.

W. L. WESTON, manager of the Houghton County Traction Company, Houghton, Mich., has received the commission of first lieutenant in the United States Infantry.

F. R. COATES, president of the Toledo Railways & Light Company, and chairman of the Toledo Board of National Defense, was recently appointed one of a committee of 10, by Governor Cox, to visit and inspect the military training camps at Fort Sheridan, Ala., and Camp Sherman, at Chillicothe, Ohio.

EDWARD J. NEARY has been granted leave of absence as electrical engineer for the Public Service Commission, First District, New York, to accept an appointment as electrical officer on board U. S. S. Utah, with rank of lieutenant. Mr. Neary is a graduate of the Pennsylvania State College, and has put in ten years in electrical work, having been with American Gas & Electric Company, Henry L. Doherty & Company, Public Service Commission, and other organizations.

WESTERN ELECTRIC COMPANY devotes the cover page of its January issue of Western Electric News to its service flag and flags of the allied nations at war. This service flag, which is shown in colors, has the figures 2375 formed by blue stars, surrounded by other blue stars on the white background and the white space center forms the outline of a five-cornered star. The flags of the allied nations are also shown in original colors. In the issue are a number of items regarding the company's men in service and a picture is also shown of the service flag that flies from the West Street Building in New York City, which contains 334 stars.

P. M. HATCH, who has been manager of the Pone Electric Company, P. R., is now in the ordnance department at Washington, D. C.

C. C. FERGUSON, of the Western Union Telegraph Company's San Francisco office, is now chief radio electrician in the United States Naval headquarters at London, England.

J. W. DIETZ, of the Western Electric Company, has been assigned by the Government to duty in organizing and training men for technical duties, his work being at Camp Pike, Little Rock, Ark.; Camp Shelby, Hattiesburg, Miss.; Camp Beauregard, Alexander, La.

EUGENE C. HIGGINS, of the educational staff of Western Electric Company, has been commissioned as captain in the U. S. Signal department, as instructor of registered signal corps men in training. Captain Higgins graduated in electrical engineering at the Iowa State College in 1902. The training of men in this department is conducted by means of night schools. About 5,000 young men will thus be instructed under Captain Higgins' general direction.

HARRY L. BROWN, western editorial representative of the Electric Railway Journal, with headquarters in Chicago, has accepted a temporary appointment as radio engineer in the office of the Chief Signal Officer, United States Army, Radio Division, Washington, D. C. He will have direct charge of the work of preparing literature for use as instructional material in the special radio courses which are being established at many of the engineering colleges throughout the country in co-operation with the Signal Corps.

CLAYTON W. PIKE, consulting engineer of the Utilities Bureau, Philadelphia, has been commissioned a Major in the Ordnance Department of the army. Major Pike was born in 1866 and is a graduate in electrical engineering of the Massachusetts Institute of Technology. In 1890 he was connected with the Merrimac Manufacturing Company, having charge of electric lighting, power and signals. He was instructor in electrical engineering in the University of Pennsylvania during 1891 and 1892 and during the two following years served Queen & Company, as electrical engineer. In subsequent years he was electrical engineer for the Falkenau Engineering Company, and from 1900 to 1910 was vice-president and general manager of the Keller-Pike Company, electrical engineers and contractors. He later became chief of the Electrical Bureau of Philadelphia, and resigned in 1916 to become engineer of the Utilities Bureau, which position he now holds. Mr. Pike has been widely and actively connected with technical and engineering societies, among which are the Society of Municipal Engineers, A. I. E. E. and Electrical Section of Franklin Institute.

Personal

M. C. Gilman Appointed Secretary of Canadian Association —H. W. Stortz Joines Swartz Electric—G. H. Losey Resigns

FRANK CARDER has been appointed manager of the Oklahoma Gas & Electric Company, Norman, Okla., division, succeeding W. P. Jones, resigned.

LESTER S. READY, who for several years has been assistant engineer in the gas and electric department of the Railroad Commission of California, has been promoted to electrical engineer of that department, succeeding F. Emerson Hoard, who is now in government service.

EUGENE C. CLARKE has joined the Tacoma Railway & Power Company, Tacoma, Wash., to direct the instruction of the trainmen and to handle general efficiency work. He resigned as supervisor of instruction for the Brooklyn Rapid Transit Company, Brooklyn, N. Y.

LEO H. GAMP, formerly associated with the St. Louis office of the F. E. Newbery Electric Company, has organized the Gamp Electric Company and will engage in a general electrical construction business. The offices of the new company will be located at 1625-26 Chemical Building, St. Louis, Mo.

H. A. COWGILL has received the appointment of general superintendent for the Mansfield Electric Light & Power Company, Mansfield, Ohio, and will assume charge of its electric railway lines, this being one of the properties controlled by Henry L. Doherty & Company. Mr. Cowgill was formerly engineer of maintenance of way for the St. Joseph Railway, Light, Heat & Power Company.

AUGUST HARTH, of Chatham, N. J., superintendent and electrical engineer of the National Electric Utilities Corporation of Connecticut, has recently designed a new type of electrical oven which has met the approval of the Navy Department, and has received a contract to supply 300 to be installed on various vessels. Mr. Harth has also designed many other electrical equipments for the Government.

JOHN W. KELLY, electrical chief of Camden, N. J., on January 26, entertained several electrical chiefs of other cities, members of the Association of Municipal Electrical Workers. Among those present were: Clark Diehl, of Harrisburg, Pa.; Frank Shinner, Atlantic City, N. J.; Robert Stewart, New Brunswick, N. J.; Richard Smith, Norfolk, Va.; James B. Yeadle, Baltimore, Md.; P. J. Beisel, Allentown, Pa.; Frank Williams, Elizabeth, N. J.; William I. Canada, of the American International Ship Corporation, and Doctor Watson, of the Electrical Fuse Company. The object of the conference was to consider what the municipal electricians could do to safeguard the cities under their control. Many valuable suggestions were made and concert of action was arranged, which, it is believed, will be mutually beneficial.

JAMES P. POWER, of Crookston, Minn., has been appointed sales representative of the Northwestern Electric Equipment Company, St. Paul, Minn. Mr. Power succeeds T. W. Fredericks, now in the service of the United States Government.

C. N. BINDER, of the Binder Electric Elevator Company, was elected president of the Birmingham Electric Club at the first meeting for the purpose of organization held at the Hilman Hotel. Other officers chosen were H. P. Davidson, of the Western Electric Company, vice-president; J. M. Middlebrooks, of the Middlebrooks Electric Company, treasurer, and H. G. Smith, of the Matthews Electric Supply Company, Secretary.

GEORGE H. LOSEY, assistant general superintendent and electrical engineer for the Indiana Railways & Light Company, Kokomo, Ind., has resigned to become connected with the Great American Refining Company, Tulsa, Okla. Mr. Losey has been with the Indiana company for the last ten years in various engineering capacities, starting in the meter department and advancing steadily through a line of promotions. He is a graduate in the electrical engineering course of Purdue University.

M. C. GILMAN, sales manager of the Toronto Electric Light Company, Ltd., has been appointed secretary of the Canadian Electrical Association, succeeding Alan Sullivan, who resigned. Mr. Gilman was graduated in 1907 from the electrical engineering course at Pratt Institute, Brooklyn, N. Y., and has since devoted his time to central-station work. In subsequent years he served the Edison Electric Illuminating Company, of Brooklyn, as assistant power engineer; power engineer of the Public Service Electric Company, Newark, N. J.; power engineer of the Virginia Railway & Power Company, Richmond; power engineer of the Toronto Electric Light Company, assistant to the chief engineer and for the last four years has been sales manager of that company.

H. W. STORTZ, for many years connected with the Edison Storage Battery Company, Orange, N. J., has resigned to become vice-president and general sales manager of the Swartz Electric Company, Indianapolis, Ind. While in the employ of the Edison company he served it efficiently as sales manager of the mine lamp department, sales manager of the industrial truck and tractor department, and sales manager of the house lighting department. Mr. Stortz possesses a thorough knowledge of electrical engineering and merchandising, and has been especially successful in organizing the departments mentioned above. If Mr. Stortz has been more successful in one line of endeavor than another, it has been in the development of the popularity of the Edison Storage Battery for use with house lighting plants. The Swartz Electric Company manufactures a very high grade of automatic lighting plants which use Edison storage batteries exclusively. The company is to be congratulated in securing a vice-president and general sales manager who is so thoroughly fitted by broad and successful experience in the development, manufacture and distribution of house lighting plants.

HOWARD PETT, manager of the Consumers' Power Company, Albion, Mich., has been appointed superintendent of power distribution of the company, succeeding H. W. Courville.

HARLOW MOORE is now connected with the Board of Fire Underwriters in Portland, Ore., having resigned as district manager for the Pacific Power & Light Company at Seaside, Ore.

W. E. RICHARDS, electrical engineer of the Toledo Railways & Light Company, has been appointed a member of the electrical safety committee of the Industrial Commission of Ohio.

A. H. FIRNHABER, who has been engaged in the electrical business for the last 13 years, has been appointed to the sales force of the Duluth office of the Northwestern Electric Equipment Company, St. Paul, Minn.

C. H. SANDERSON, who has been connected with the Havana Electric Railway, Light & Power Company as assistant chief engineer, has resigned to become manager of the auto and truck department of the Frank G. Robbins Company, of New York and Havana.

A. J. BUSH, JR., Dallas, Tex., has been appointed assistant to the general manager of the Texas Electrical Railway, Dallas, the consolidated Strickland lines. Mr. Bush will have his headquarters in Waco, being in charge of the Waco division of the railway and will also manage the Waco city system, which is owned and operated by the Texas Electric Railway.

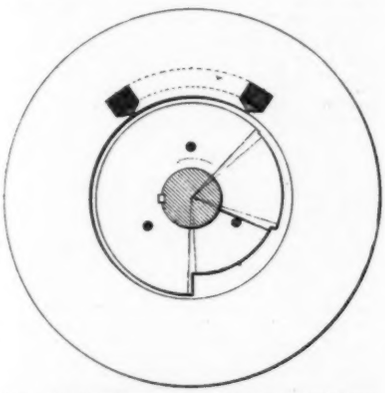
SAMUEL INSULL, chairman of the Illinois State Council of Defense and president of the Commonwealth Edison Company, Chicago, has retired from the presidencies of the West Penn Railways Company and the Western Power Company, Pittsburgh, Pa. He has been succeeded by A. M. Linn, one of the officers of the American Water Works Company, the holding concern in connection with the two companies mentioned. Inability to devote the time necessary to the two companies is given as the reason for the retirement of Mr. Insull. He became president of the West Penn Railways Company following the organization of that concern several years ago, and also retired from other corporations within the last few years, including the United Light & Railways and the Pacific Gas & Electric Company.

Recent Patents

Selected and Summarized by Albert Scheible, Patent Attorney, 79 West Monroe Street, Chicago, Illinois

Emergency Stop for Electrically Driven Apparatus (1,250,708).—For quickly and positively stopping an electric motor, Caswell D. Swett, of Redwood City, Cal., provides circuit connections to a special type of pole-changing switch. In operation, this first reverses the polarity so as to utilize the reverse torque in stopping the motor, and then shifts the switch connections to a neutral position so as to prevent the motor from running in the reverse connection.

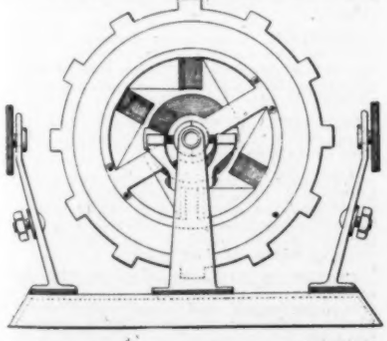
Alexanderson Alternator (1,250,752).—This patent, issued on an application filed in August, 1914, covers a generator described by E. F. W. Alexanderson in his memorable paper before the A. I. E. E. and now



No. 1,250,752.—Alexanderson High-Frequency Alternator.

widely used in wireless practice for producing alternating currents of a highly unsymmetrical wave form. The patent stands assigned to the General Electric Co.

Rotary Spark-Gap Machine (1,250,385).—Allied in purpose is the generator patented by Clarence H. Teall, of Detroit, who partially diminishes the spark gap by interposing a rotary conductor carrying a number of sparking points, thereby increasing the surging of the current without decreasing the efficiency of the gap.



No. 1,250,385.—Rotary Spark-Gap Machine.

A series of brief comments on some of the recently issued electrical patents which appear to be of particular interest to our readers, the number after each heading being that of the United States patent to which the summary relates. Any correspondence regarding such patent matters should be sent direct to Mr. Scheible at the above address.

Controller for Electric Vehicles (1,250,144).—Instead of fastening the controlling mechanism to the dashboard or other rigid part of the vehicle, De Witt C. Cookingham, of Lakewood, Ohio, fastens it to a swivel seat and arranges it so that its operability depends on the position of this seat. The patent was assigned to the Baker R. & L. Co., of Cleveland.

Electropneumatic Brake (1,251,596).—Walter V. Turner, of Pittsburgh, has assigned to the Westinghouse Air Brake Company this patent on an air-brake arrangement, the purpose being to provide an emergency application of the brake in case the regular brake-actuating circuit fails.

Lamp Dimmer (1,252,203).—A contact brush moving over a coiled wire resistance within the regular socket shell forms the active part of a compact dimming socket patented as a "rheostat" by William F. Valcker, Jr., of Chicago.

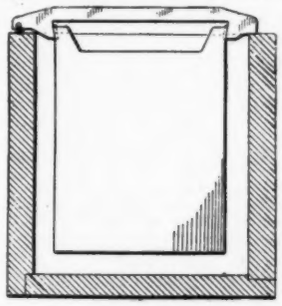
Switch for Storage-Battery Systems (1,250,152).—A branch circuit leading to the contacts through a circuit-breaker is used by Carl W. Eisenmann (of Nebraska City, Nebr.) for automatically puncturing any insulating material between the switch contacts at the moment of closing the switch, so as to insure an instantaneous flow of current from the generator to the battery.

Telegraph Circuit-Closing System (1,251,320).—When a telegraph circuit at a local office is open (for instance, in case the local switch is open, or the relay wire is broken) the circuit may be closed from the main office according to this system. For this purpose Frederick A. Anderson, of Portage La Prairie, Manitoba, provides a normally open shunt around each telegraph set, which may be closed from the main office.

Alkaline Battery Cell (1,250,460).—To reduce the weight, the number of filler openings, and the resistance due to electrical connections, Walter E. Holland, of Detroit, constructs Edison batteries in a twin form. Each unit has two compartments, and the negative element of one compartment is both mechanically and electrically connected through the intervening partition with the positive element in the other compartment.

Telegraph Recorder (1,250,961).—In recording instruments as commonly used in submarine telegraphy, it had been customary to record impulses of different polarity by markings above or below the center of the moving tape. Line disturbances often modify these markings or even render them wholly illegible. Hence, William M. Bruce, Jr., of Springfield, Ohio, substitutes an apparatus in which differently colored or otherwise distinctive markings are made by the two polarities, and in which the tape is held stationary during the marking. The patent stands assigned to the United Telegraph & Cable Co., of the same city.

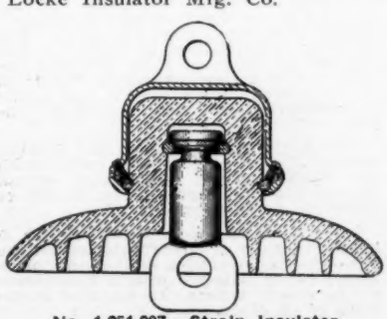
Electrode for Electrolytic Refining (1,250,757).—Instead of casting lugs on the anodes, or using rods and



No. 1,250,757.—Electrode for Electrolytic Refining.

hooks for suspending them, Frank L. Antisell provides a suspending bar with wedge-shaped parts which interlock directly with the anode. This makes it possible to space the plates more closely, and avoids the power losses which are considerable in electrolytic metal refining.

Strain Insulator (1,251,097).—Clever means for cheaply assembling the parts of strain insulators (of the type commonly suspended in series with one another) are shown in this patent to John M. Peck, of Victor, N. Y., which stands assigned to the Locke Insulator Mfg. Co.



No. 1,251,097.—Strain Insulator.

Current News

Weekly Record of Construction Activities—Conventions

EASTERN STATES.

BOSTON, MASS.—West End Street Railway Company has been authorized by the Public Service Commission to issue bonds for $375,000 for the purchase of new rolling stock, improvements, etc.

PROVIDENCE, R. I.—Queen Dyeing Company, Valley street, has commenced the construction of a new addition to its power house. The structure will be two stories and will cost $7000.

BINGHAMTON, N. Y.—Binghamton Light, Heat & Power Company is making rapid progress in the construction of the new addition to its power house, and has commenced the installation of new boilers.

BROOKLYN, N. Y.—The United States Government, Bureau of Yards & Docks, has awarded a contract for the erection of its proposed new power house at the local navy yards to the Marble Architecture Company, Broadway and Two Hundred and Sixteenth street, New York. The estimated cost is $255,920.

BROOKLYN, N. Y.—Plans have been completed by the Brooklyn Union Gas Company, 176 Remsen street, for alterations and improvements in its one-story brick gas plant on Fifth street. The work is estimated to cost $40,000. Contract has been awarded to the George A. Fuller Company, 175 Fifth avenue, New York.

BROOKLYN, N. Y. — Interborough Rapid Transit Company, 165 Broadway, New York, has had plans prepared for the construction of a new one-story brick transformer station, about 50x100 feet, on Livonia avenue, near Rockaway avenue. George H. Pegram, 165 Broadway, is the architect.

BUFFALO, N. Y.—The City Council is installing a new underground conduit system in about a mile of city streets, for the police and fire alarm systems, the entire work when completed being estimated to cost $60,500. A bond issue for this purpose is being arranged.

BUFFALO, N. Y.—Permission has been granted by the Public Service Commission to the Niagara, Lockport & Ontario Power Company, Marine Bank Building, to take over and operate the Salmon River Power Company.

BUFFALO, N. Y.—Fire, on January 26, destroyed a portion of the plant of the Westinghouse Electric & Manufacturing Company, Lock street, with a total loss estimated at approximately $150,000. The company will immediately rebuild the destroyed sections.

GLOVERSVILLE, N. Y.—Glenn Telephone Company has had plans prepared for the construction of a new two-story brick telephone exchange plant, about 30x40 feet. McKenzie, Voorhees & Gmelin, 1123 Broadway, New York, are the architects.

NEW YORK, N. Y.—Bijur Motor Lighting Company, 87 West End avenue, manufacturer of motor lighting and starting apparatus, has been placed under a receivership following the filing of an equity suit by the Cleveland Automatic Machine Company, Cleveland, Ohio. The company is capitalized at $1,625,000, has existing liabilities of $1,225,000, and assets said to be approximately $2,000,000. E. B. Wilson, Joseph Bijur and Louis V. Hubbard have been appointed receivers.

UTICA, N. Y.—Langdon & Hughes Electric Company has filed notice with the Public Service Commission of an increase in its capital from $5,000 to $50,000 to provide for expansion.

DOVER, N. J.—New Jersey Power & Light Company is now furnishing all the power for the operation of the large plant of the Dover Boiler Works, manufacturer of furnaces, boilers, tanks, and platework of all kinds.

JERSEY CITY, N. J.—Public Service Electric Company is now furnishing electric power to a number of the new shipbuilding companies in the Kearny meadow district, including the Submarine Boat Company, an agent of the Emergency Fleet Corporation; the Foundation Company, Federal Shipbuilding Company, New York Shipbuilding Company, and New Jersey Shipbuilding Company.

JERSEY CITY, N. J.—The Board of Freeholders of Hudson County is having plans prepared for the construction of its proposed new one-story brick power house, heating and lighting plant at Laurel Hill. The project is estimated to cost $150,000. Percie A. Vivarttas, 110 Fourth street, West New York, is the architect.

KEARNY, N. J.—The Council is planning for immediate extension and improvement of the electric fire alarm system.

LAMBERTVILLE, N. J.—In its annual budget for 1918, the City Commission has approved an appropriation of $5100 for the operation of its electric street-lighting system.

NEWARK, N. J.—The Board of Freeholders has rescinded the contract recently awarded to the Beaver Engineering Company, Newark, for electric light and power wiring in the laundry at the County Hospital, Overbrook, at a price of $14,174. The proposition was vetoed by County Supervisor Lewis G. Bowden, and sustained by a vote of 6 to 2.

PERTH AMBOY, N. J.—Roessler & Hasslacher Chemical Company has conveyed to the General Bakelite Company, manufacturer of insulation specialties, a subsidiary organization, property at the northeast corner of Fayette and Rector streets. It is said that the site will be used for extensions.

TRENTON, N. J.—Due to the extremely high cost of labor, materials, etc., the State House Commission has temporarily postponed the construction of its proposed new electric plant at the New Jersey State Hospital, the estimated cost of which was to have been $50,000.

TRENTON, N. J.—In connection with a report of the local traction system made for the City Commission, it is recommended that the Trenton & Mercer County Traction Company discontinue its power house and arrange for the purchase of current from the Public Service Corporation. Peter E. Hurley is general manager.

WEST ORANGE, N. J.—The Town Council has approved an appropriation of $26,000 in its annual budget for 1918, to provide for electric street lighting.

ALTOONA, PA.—Penn Central Light & Power Company has filed notice with the Public Service Commission of the issuance of bonds for $537,000 to provide for improvements, etc.

ERIE, PA.—Erie Forge Company, Fifteenth and Cascade streets, has commenced the construction of its proposed new one-story substation, about 50x70 feet. The Stader Conrath Company, Erie, has the contract for erection.

HARRISBURG, PA.—The Public Service Commission has recently handed down an opinion directing the McKean Natural Gas Company, operating in McKean County, and with headquarters at Olean, N. Y., to continue to furnish natural gas to residents of Ceres township. The company had proposed to discontinue service and to relocate a line. The Commission holds that the defendant, being a public service company, "is required to render service to all persons who desire it in the territory in which it is chartered, and which, by a reasonable outlay, can be reached."

LANCASTER, PA.—Application has been filed with the Public Service Commission for approval of the merger of seven Lancaster County street railways into a new corporation to be known as the Conestoga Traction Company. The companies to be merged are the Lancaster Traction, Lancaster Railway, Lancaster City, Lancaster & Lititz, Columbia & Ironville, Columbia & Donegal, and the present Conestoga Traction Companies.

LEWISTOWN, PA.—Lewistown & Reedsville Electric Railway has filed notice with the Public Service Commission of a bond issue of $68,000 for extensions, improvements, etc.

PHILADELPHIA, PA.—The City Water Bureau is considering the immediate construction of a large dam and the installation of a new hydroelectric power plant at Fairmount, near Philadelphia.

PHILADELPHIA, PA.—Philadelphia Electric Company recently filed with the Public Service Commission an application for the approval of an increase in its lighting rates of approximately 20 per cent. This increase will not affect municipal or residential lighting rates. The reason given for the proposed increase was the advanced cost of labor, materials, etc. Joseph B. McCall is president.

PHILADELPHIA, PA.—Announcement has been made by Dr. Harold Pender of the faculty of the University of Pennsylvania, that a course in radio communication designed to fit students for enlistment in the signal corps of the army, will be added to the curriculum of the Electrical Engineering School. It is anticipated that there will be a large enrollment. Students completing the course and enlisting in the signal corps will be sent to special Government schools for further training. Opportunities will be afforded for qualifying as noncommissioned officers, with possible advancement to commissioned grades.

PHILADELPHIA, PA.—The city water bureau has drawn up plans for the construction of a permanent masonry dam at Fairmount, permitting the installation of a hydroelectric plant to develop power from surplus water during a portion of the year. The plant will be used in connection with the operation of the Belmont pumping station, which supplies all the water for West Philadelphia, the George's Hill standpipe station and the Belmont filters.

WILLIAMSTOWN, PA.—Lykens Valley Light & Power Company has filed notice with the Public Service Commission of the issuance of bonds for $15,000 to provide for improvements.

BALTIMORE, MD.—Corkran, Hill & Company, 221-7 South Howard street, is having final plans prepared for the construction of a new power house at its plant, Sixth street, near Wilkens avenue.

BALTIMORE, MD.—Crown Electric Company, 149 North Gay street, has awarded a contract for the construction of a new two-story addition, about 25x80 feet, to its plant. L. Schoenlein, Jr., Guenther Building, Baltimore, is the contractor.

BRISTOL, VA.—King College is considering the early construction of a new one-story brick and stone power house to cost about $30,000. C. B. Kearfoot, Bristol, is the architect

WALHALLA, S. C.—Oconee Telephone Company will rebuild its exchange which was destroyed by fire.

ATLANTA, GA.—The city council has adopted a resolution providing that the committee on electric and other railways be requested to secure estimates and bids for the construction of an electric generating plant at crematory.

COCHRAN, GA.—The city contemplates extensions and improvements to its electric light plant and waterworks to cost $5000. Address C. W. Davis, superintendent.

NORTH CENTRAL STATES.

CLEVELAND, OHIO.—The City Council has passed the ordinance authorizing the director of public utilities to expend $500,000 for enlarging and extending the Cleveland Municipal Electric Light and Power Plant and Distribution System connected thereto. Thomas S. Farrell is director of public utilities, and W. E. Davis is lighting commissioner; each may be addressed at the City Hall, Cleveland.

WOOSTER, OHIO.—John Le Chott, of Orville, has been awarded the contract for the erection of an $18,000 addition to the Wooster and Orville telephone building. Address E. A. Pool, local manager.

YOUNGSTOWN, OHIO.—Central Union Telegraph Company has appropriated $300,000 for improvements, $250,000 of which will be used for outside equipment, such as cables, lines, wires, etc.

YOUNGSTOWN, OHIO.—Mahoning & Shenango Railway & Light Company will invest $50,000 in new machinery and equipment, such as electric apparatus, street cars, etc.

EVANSVILLE, IND.—Schroeder Headlight & Generator Company, with capital of $150,000, has incorporated to manufacture and sell headlights. William H. McCurdy, John D. Craft, William A. Carson, Albert F. Karges, Marcus S. Sonntag, J. H. Schroeder and S. W. Cook are the incorporators.

AURORA, ILL.—Western United Gas & Electric Light Company has been allowed authority by the Illinois Public Utilities Commission to issue general mortgage gold bonds in the amount of $180,000.

LINCOLN, ILL.—A generator to be used by the Lincoln Municipal Railway is to be installed in the plant of the Lincoln Water & Light Company.

PEORIA, ILL.—The Peoria Railway Company has been given authority by the Illinois Public Utility Commission to issue general mortgage five per cent gold bonds in the amount of $93,000.

SYCAMORE, ILL.—A license to incorporate has been granted the Geneva Lake, Sycamore & Southern Railway, which proposes to build an electric line from the south shore of Geneva Lake, through McHenry, De Kalb, Kendall and La Salle counties. The company is capitalized at $150,000 and has its main offices at Sycamore. Address A. E. Hammersmith.

DETROIT, MICH.—Disco Electric Manufacturing Company has taken over the bankrupt Disco Electric Starter Company and plans the extensive manufacture of starters for Ford cars. Dean Emerson has been named general manager of the new company, and Harry F. Prescott, sales manager.

MADISON, WIS.—E. E. Parker, city engineer, is preparing plans for an electric substation on Sprague street.

BLOOMFIELD, IOWA.—The city will expend $8,000 for improvements on the municipal light plant. The specifications include two electric generators, one 225 kilowatt and one 75 kilowatt alternating current, two 150 horsepower boilers and brick smokestack. Address T. Z. Millard, general superintendent.

CEDAR RAPIDS, IOWA.—Extensions to cost $40,000 are contemplated by the Iowa Telephone Company, including the installation of 30 blocks, conduits, tile, etc. J. M. Rider, manager.

CORYDON, IOWA.—The installation of a generator in the municipal electric light plant is under consideration by electric light commissioners. A. T. Gallagher, clerk.

ELKADER, IOWA.—Extensive improvements are being made by the Standard Telephone Company, which include the laying of underground cables and an aerial cable, which is to be stretched all over town. The work will require 20,000 feet of wire and will cost $13,000.

FAIR PLAY, MO.—A stock company is being formed for the purpose of building a hydroelectric plant at Bear Creek. The plant is intended to supply electric power for Fair Play and the neighboring towns and is to be erected at a cost of $20,000.

ST. LOUIS, MO.—Plans have been prepared by L. R. Timlin, architect for the Southwestern Telephone Company for a telephone exchange to be erected at Delmar and Lake avenues at a cost of $85,000.

DATES AHEAD.

New Mexico Electrical Association. Annual meeting, Silver City, N. Mex., February 11-13, 1918.

American Institute of Electrical Engineers. Midwinter convention, New York City, February 15-16, 1918. Secretary, F. L. Hutchinson, 33 West 39th Street, New York City.

Illinois Electrical Contractors' Association. Semi-annual convention, Chicago, February 22-23, 1918. Secretary-Treasurer, L. B. Van Nuys, 238 South Jefferson Avenue, Peoria, Ill.

Vermont Electrical Association. Annual meeting February, 1918. Secretary-Treasurer, C. H. West, Rutland, Vt.

National Association of Electrical Inspectors. Annual convention, New York, March, 1918. Secretary-Treasurer, William L. Smith, Concord, Mass.

Wisconsin Electrical Association. Annual meeting, Pfister Hotel, Milwaukee, March 27-28, 1918. Secretary, George Allison, 1419 First National Bank Building, Milwaukee, Wis.

Tri-State Water & Light Association. Annual meeting. Charlotte, N. C., April, 1918. Secretary-Treasurer, W. F. Steiglitz, Columbia, S. C.

American Association of Engineers. Annual meeting, May 14, 1918. Secretary-Treasurer, A. H. Krom, 29 South LaSalle Street, Chicago.

National Electrical Credit Association. Annual meeting, June 1, 1918. Secretary, Frederic P. Vose, 1350 Marquette Building, Chicago, Ill.

Texas State Association of Electrical Contractors. Annual meeting, Galveston, Tex., June 15, 1918. Secretary, H. S. Ashlay, Fort Worth, Tex.

Southeastern Section, National Electric Light Association. Annual meeting, June 19-20, 1918, Atlanta, Ga. Secretary-Treasurer, T. W. Peters, Columbus, Ga.

Northwest Electric Light & Power Association; affiliated with N. E. L. A. Annual meeting September 11, 1918. Secretary, George L. Myers, Pacific Power & Light Company, Portland, Ore.

Kansas Public Service Association. Annual meeting, Kansas City, Kans., October 17-19, 1918. Secretary-Treasurer, W. W. Austin, Cottonwood Falls, Kans.

FALLS CITY, NEB.—Plans, involving the expenditure of $78,000, have been prepared by Engineer E. M. Stevens, Kansas City, Mo., for improvements on the light and water system. Address J. C. Mullen, city clerk.

FREMONT, NEB.—Wright Electric Construction Company has been awarded contract for installing a water, light and lighting plant at Pender to cost $10,989.

MITCHELL, S. DAK.—Burns & McDonnell, engineers, Kansas City, Mo., have prepared plans for improving the light and water system. Address R. E. Davis, city auditor.

FULLERTON, N. DAK.—A franchise has been granted to G. F. Phillips, of the Ellendale Electric Company for electric transmission lines from Ellendale to Fullerton and Monango.

MADDOCK, N. DAK.—Engineer W. E. Skinner, Minneapolis, Minn., is preparing plans for a $7,000 municipal light system. Address town clerk.

SOUTH CENTRAL STATES.

LOUISVILLE, KY.—Central Kentucky Light & Power Company has incorporated with a capital stock of $12,000 to buy and sell electrical equipment and build and install electric light and power plants. The company will establish its main office at Lexington, Ky. The incorporators are E. L. Uncapher, Cincinnati, Ohio; W. R. Katterjohn, Paducah, and Edward Johnson, Lexington, Ky.

LOUISVILLE, KY.—During the week ending January 11, the Louisville Gas & Electric Company has announced the securing of forty new electric light and power customers.

MAYFIELD, KY.—The city has issued $272,000 bonds for taking over the plant of the Mayfield Water & Light Company. Address E. A. Stevens, mayor.

WALTON, KY.—Walton Electric Light Company contemplates the purchase and installation of an electric generator to be directly connected to the engine already installed. Address E. L. Kelly, manager.

CLINTON, TENN. — Clinton Power Company has purchased the local electric light plant and will improve and enlarge the service. The company has a capital of $20,000. Address E. C. Cross, president.

FRIENDSHIP, TENN.—Robertson & Cherry have purchased the distributing system and other equipment of the Friendship Electric Light & Power Company, and have installed a dynamo in their mill. They will give service to the community.

MUSCLE SHOALS, ALA. — United States Government is planning for the construction of a large new hydroelectric plant on the Tennessee River, near South Florence, to provide power for the operation of the large nitrate plant at Muscle Shoals now in course of construction. The project is estimated to cost $13,500,000.

HOBART, OKLA.—Tosh Telephone Company has been chartered with a capital of $4000 by William J. Ball and others.

OKLAHOMA CITY, OKLA.—The three story building occupied by the Nunn Electric Company has been destroyed by fire. The loss is $40,000.

BOWIE, TEX.—The attorney general has approved an issue of $15,000 electric light bonds. Address Mayor.

DALLAS, TEX.—Lawrence Electric Company has changed its place of business to El Paso and decreased its capital stock from $25,000 to $20,000.

HARLINGEN, TEX.—The city has leased its water and light plant to A. Goldammer for a term of five years. Mr. Goldammer will extend the service and will also erect an ice plant.

SABINAL, TEX.—R. T. Robinson, San Antonio, has recently acquired the electric light plant of the Sabinal Light & Ice Company, and is said to be considering extensive improvements to provide for increased capacity.

SAN BENITO, TEX.—Commonwealth Electric Light & Water Company is considering the erection of an addition to its power house, and the installation of new equipment including a new 100-horsepower engine.

WESTERN STATES.

PHOENIX, ARIZ.—James B. Girard has resigned as city engineer of Phoenix to devote his time to the development of a big hydro-electric project in the Grand Canyon. Eastern capitalists are interested in the project. The project involves the construction of a dam in the Colorado River near Diamond Creek and the installation of high pressure turbine engines. Permits have been secured for the erection of six dams, but only one will be constructed at the present time. The project calls for an ultimate outlay of about $12,000,000.

BELLINGHAM, WASH.—Farmers Mutual Telephone Company has voted in favor of issuing bonds in the sum of $20,000 to restore its lines, about 50 per cent of which were destroyed in the recent flood.

ELLENSBURG, WASH.—Henry C. Mills and others have petitioned the county commissioners for a 50-year franchise to construct and maintain an electric line over certain highways.

SEATTLE, WASH.—Star Machinery Company, operating an extensive plant for rebuilding machinery at 1731 First avenue South, Seattle, has taken out a permit to erect a $10,000 shop at 207 Horton street and among other new equipment will install a 15-ton electric crane to run the full length of a 120 foot building.

TACOMA, WASH. — The city has awarded a contract to the American Nitrogen Products Company for furnishing 6600 volts of electricity for a period of five years on a sliding scale of from $6 to $10 kilowatt year.

TACOMA, WASH.—City Light & Power Company is making surveys for a site for its plant, which is to have a capacity of 17,000 horsepower and to cost approximately $1,000,000.

TACOMA, WASH.—Surveys of four sites tributary to the Nisqually River are being made by Lieweilyn Evans, superintendent of the city light plant, for an additional power plant having a capacity of 17,000 horsepower. N. L. Taylor of the light department is making the estimates of costs and as soon as this preliminary work is completed will start construction work. The project will cost $1,000,000.

WINLOCK, WASH.—A deal transferring the Toledo, Winlock, Vader and Napavine franchises held by the Independent Electric Company to the Idaho-Washington Water, Light & Power Company was consummated recently.

VANCOUVER, B. C.—Ontario Power Company has appropriated $1,800,000 for additions to its plant.

PROPOSALS

GENERATOR.—Bids will be received on February 15 for the installation of a 60 kilovolt ampere, 2-phase, 60-cycle, 220 volt alternating-current generator, directly connected to engine, at the Perry Water Works. Specifications and profile of plant may be obtained at the office of the city clerk, Perry, Iowa. Address Adrian Cross, city clerk.

ELECTRIC PUMP.—Bids for an electrically-driven deep well pump with a daily capacity of 1,000,000 gallons have been opened by the city board of purchase of Savannah, Ga. The pump will be installed at the Springfield well and the water department plans to discontinue operation of the river station after its installation.

ELECTRICAL FIXTURES.—Bids will be received at the office of the board of commissioners of Cuyahoga County, Ohio, February 6 for electrical fixtures, per report No. 4115 in accordance with the form of contract and specifications to be furnished by W. A. Stinchcomb, county surveyor. Address E. G. Krause, county clerk.

TRANSFORMERS, CABLE, COPPER WIRE, ETC.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until February 11, for furnishing soft steel, structural steel, plate steel, 100 feet black pipe, transformers, 15,000 feet cable, copper wire, 3000 feet conduit, 645 fixtures, one electric range, 600 reflectors, 75 resistance units, one feed pump, three hoist blocks, etc.

CENTRIFUGAL PUMP.—Bids will be received by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for piping and accessories, a turbine-driven centrifugal pump, structural steel foundations, and miscellaneous work in connection with the installation of new equipment in the central power plant at the navy yard at New York, N. Y.

HYDROELECTRIC LIGHT AND POWER PLANT.—The Board of Public Works, Seattle, Wash., will receive bids until 10 a. m., March 1, for the construction of a hydroelectric light and power plant. C. B. Bagley, secretary.

INCORPORATIONS

NEW YORK, N. Y.—Technical Production Company, Inc., incorporated with a capital of $25,000 and will engage in the manufacture of wiring and electrical supplies. Incorporators: J. Lampel, G. H. Hyman, and H. Lampel, 580 Fifth avenue, New York.

NEW YORK, N. Y.—Wedge Joint Corporation has incorporated to manufacture engines, boilers, etc. The company which is capitalized at $100,000, has as its incorporators E. S. Merrill, T. F. Vandorn, and J. A. Twichell, 316 West Seventy-ninth street.

BUFFALO, N. Y.—Meridian Electric Company, Inc. Capital, $50,000. To engage as electrical engineers, and to manufacture electrical supplies. Incorporators: A. F., J., and E. M. Keppel, Ebenezer.

ELIZABETH, N. J.—Hickey & Schneider, Inc. Capital, $10,000. To engage in a general electrical repair business. Incorporators: Albert F. Bender, John Schneider, and A. J. Bender, Elizabeth.

NEW YORK, N. Y.—Domestic Electrical Export Company. Capital, $200,000. To engage in the exportation of electrical supplies. Incorporators: J. J. Hayden, A. H. Gleason, and D. Barnet, 258 Broadway.

NEW YORK, N. Y.—Nathan A. Kriecher, Inc. Capital, $50,000. To manufacture electrical supplies. Incorporators: N. A. Krischer, M. Krischer, and J. Weinstock, 1459 Minford Place, Bronx.

PEORIA, ILL.—Domestic Electric Appliance Company has incorporated with a capital of $12,000. The incorporators are R. B. Cherry, V. E. Hopkins and E. G. Kuecks.

LOUISVILLE, KY.—Rural Light & Power Company has incorporated to build, install, purchase and sell electric lighting and power plants in small towns and rural communities and is capitalized at $6,000. The incorporators are W. R. Katterjohn, R. M. Thompson and A. H. Thompson.

COTTONWOOD, S. D. — Cottonwood Valley Telephone Company. Capital, $25,000. Incorporator, Charles Shannon.

FARGO, OKLA.—The Eight Mile Mutual Telephone Company. Nominal capital, $5000. To operate a telephone exchange plant. Incorporators: O. D. Cartrell, A. M. Harvey, and J. A. Thompson, Okla.

HARRISON, N. J.—The Standard Wire Company. Capital, $50,000. To manufacture wire of various kinds. Incorporators: John W., H. J., and L. E. Laffey, Paterson.

NEW YORK, N. Y.—The Sun-Light Arc Company, Inc. Capital, $300,000. To manufacture patented arc lights. Incorporators: E. M. James, M. M. Eisenberg, A. C. Head, 181 Martense Street, Brooklyn.

NEW YORK, N. Y.—Albert F. Ganz. Capital, $12,000. To manufacture systems for the mitigation of electrolysis. Incorporators: R. J. Jacobus, E. L. Hegeman, and F. L. R. Francisco, 511 Fifth Avenue.

WILMINGTON, DEL. — Remington Electric Welder Company was recently incorporated with a capital of $300,000 to manufacture electric welding apparatus. M. E. and A. Smith and M. E. Doto are the incorporators.

BUFFALO, N. Y.—Evanwood Battery Corporation has incorporated with a capital of $500,000 to manufacture electric batteries, etc. The incorporators are R. H. Templeton, H. J. Wood and H. E. Evans.

NEW PUBLICATIONS

METHOD FOR TESTING CURRENT TRANSFORMERS.—The Bureau of Standards, Washington, D. C., has issued its Paper No. 309, entitled "A Method for Testing Current Transformers," by Francis B. Silsbee, associate physicist. This paper describes in detail a method for testing current transformers. This is a method which will be found useful in commercial plants where delicate laboratory equipment is not available and where large numbers of transformers must be tested rapidly and with moderate accuracy. Two of the most convenient of the possible modifications of the general method are described in detail. This paper, which is printed in neat pamphlet form, may be obtained for five cents by addressing a request to the Bureau.

FIRING LARGE HOUSE-HEATING BOILERS.—Following tests made by the Bureau of Mines Technical Paper No. 180, prepared by S. B. Flagg, has been issued. This bulletin, which is entitled "Firing Bituminous Coals in Large House-Heating Boilers" contains a large number of recommendations expressed in such a way that the layman can understand about the manipulation of the fuel bed, and dampers, and maintenance of ash pits. The effect of mixing coals, and different methods of firing with the different coals are covered quite fully with advice as to draft and the maintenance of apparatus. Copies may be obtained free of charge by addressing the Director, Bureau of Mines, Washington, D. C.

SAFE PRACTICES. — The National Safety Council, Chicago, is sending out valuable loose-leaf literature on safe practices for accident elimination, dealing with transmission machinery, embodying shafting, couplings, pulleys, gearing, engine guarding and engine stops, and oiling devices and oilers. Much practical advice in this literature is given, which is explained by the aid of charts, diagrams and illustrations.

SOME ELECTRICAL PROBLEMS PRACTICALLY CONSIDERED is the name of a paper now distributed in pamphlet form by B. G. Lamme, chief engineer of the Westinghouse Electric & Manufacturing Company. This paper was presented at the eighth annual convention of the Association of Iron & Steel Electrical Engineers, held at Cleveland, Ohio, September 14-19, 1914. Among some of the subjects thoroughly and practically covered in this 55-page pamphlet by Mr. Lamme are insulation problems, commutation and related problems, primary circuit control, etc.

ELECTRIC POWER ON THE FARM.—Bulletin No. 25, issued by the Engineering Experiment Station of Iowa State College, Ames, Iowa, deals with Electric Power on The Farm, compiled by Adolph Shane. This bulletin, containing 62 pages, tell of the progress of electricity on the farm in the last ten years, and how farm life has been made more enjoyable by lessening the labor incident to farm and household operations by the use of electric power for pumping, churning, grinding, etc., for lighting the house and barns, and for such purposes as ironing, washing and other domestic uses in the home. The purpose of the publication is to outline an electric system of general application, and it discusses in detail a particular installation, for which certain farm conditions have been assumed, thus serving as a guide for other similar installations. Among the subjects treated are: Some Electrical Facts, The System to Be Used on the Farm, The House Installation, The Barn Installation, The Power Plant, Lighting Schedule, Estimates, Ordering Apparatus and Testing, Points on Installation and Wiring, Miscellaneous Statements and Cost of Power Production, etc. The bulletin is illustrated, showing many uses to which electric power may be applied on the farm.

ALDRED LECTURES AT JOHNS HOPKINS UNIVERSITY.—A course of lectures on "Engineering Practice" was established about a year ago at Johns Hopkins University through the generosity of J. E. Aldred, and the first series, given by prominent practicing and operating engineers, has been published. These lectures, nine in number, present the essential features of planning, construction and operation of modern engineering projects and, being open to the public, were well attended by the engineers of Baltimore. A limited number of paper-bound copies of this course of lectures, about 250 pages 6 by 9 inches, including numerous illustrations with additional folders of charts, maps and diagrams inserted, can be obtained from the Johns Hopkins Press, Baltimore, Md., for a dollar each.

JOURNAL OF ENGINEERS' CLUB.—The January number of this publication, issued by the Engineers' Club of Philadelphia, embodies about 50 pages of literature relating to subjects of current engineering interest, much of this matter pertaining to problems concerning the prosecution of the war. The "Inventions Relative to War Material" is discussed by Captain W. S. Smith of the U. S. Navy. "War in the Air" is the subject of an article by G. D. Wardrop, editor of Aerial Age Weekly, New York City. In this article some good illustrations are given. I. N. Knapp, M. E., in a lengthy article, deals with the "Future Supply of Oil" from an optimistic viewpoint. His article is instructive, and covers a wide scope. Another elaborate article is on "Industrial Housing" by H. W. Forster, in which types of housing, costs of construction, and the handling of the housing problem by employers are set forth.

Financial News

Bond Market Active.

The opening week of the year evidenced more activity in municipal, railroad, industrial and public utility bonds and a tendency toward slight improvement in prices. United States Steel 5s advanced over two points. This movement, however, was not sustained during the remaining weeks of the month and rails and industrials evidenced narrow price fluctuations.

The municipal market in the second week of the month showed signs of improvement as the result of a better inquiry from saving banks and investors. Dealers report their stocks low, and comparatively speaking there have been few offerings by municipalities. The closing week showed a still firmer tendency as the result of inquiries from institutions and investors.

Following is a list of the more important corporate issues offered:

$1,000,000 Kansas City Railways 6 per cent notes, due Dec. 1, 1919, at 97¾ and interest, to yield 7¼ per cent.

$1,360,000 Manchester (N. H.) Traction, Light & Power 6 per cent notes, due January 1, 1920, at 98 and interest, to yield 7 per cent.

$1,500,000 United Light & Railways 6 per cent notes, due May 1, 1920, at 96⅝ and interest, to yield 7½ per cent.

$10,500,000 Toledo Traction, Light & Power 7 per cent bonds, due January 1, 1920, at 98½ and interest, to yield 7.82 per cent.

$3,000,000 American Gas & Electric 6 per cent notes, due January 1, 1920 and 1921, at prices to yield about 7½ per cent.

$1,000,000 Nevada-California Electric Corporation 6 per cent notes, due January 1, 1920, at 97¼ and interest, to yield about 7½ per cent.

$2,000,000 Kansas City Terminal Railway First Mortgage 4 per cent bonds, due January 1, 1960, at 75½ and interest, to yield 5⅓ per cent.

$1,500,000 Republic Railway & Light 6 per cent notes, due January 1, 1920, at a price to yield 8 per cent.

$1,000,000 Fall River Electric Light 7 per cent notes, due January 15, 1920, at 99¾ and interest, to yield about 7⅛ per cent.

Utility Notes Offered.

West Penn Power Company recently offered two-year 7 per cent collateral gold notes to investors. A syndicate headed by Halsey, Stuart & Company, A. B. Leach & Company and the Continental & Commercial Trust & Savings Bank offered $1,500,000 of these notes (the entire issue) to dealers and the results were surprising, as they were greatly oversubscribed in a few hours after the circulars had been sent out. They are being offered to the public on a 7.80 per cent basis. Lee, Higginson Company and Halsey, Stuart & Company have bought $2,000,000 Public Service Company of Northern Illinois two-year 6 per cent notes. These firms are now forming a syndicate which will offer the notes to investors early next week. The issue is secured by $2,667,000 first and refunding 5 per cent bonds of the Public Service Company. Another utility issues is the the $1,250,000 West Virginia & Electric Company first mortgage five-year 6 per cent gold bonds, which are being offered by Elston & Company, and Powell, Garrad & Company at a price to yield the investor approximately 7 per cent.

Reserve Bank Earnings.

Combined net earnings of the twelve federal reserve banks last year amounted to $11,202,993, or at rate of 18.9 per cent on an average aggregate capital for the year of $59,260,000. This compares with net earnings of $2,750,999, or at the rate of 4.99 per cent, for the year 1916 on an estimated yearly average paid in capital of $55,178,000. Gross earning in 1917 amounted to $15,838,859, against gross earnings of $4,955,343 in 1916.

Hurley Cumulative Preferred Stock.

The Hurley Machine Company, an Illinois corporation, which manufacturers a large line of electrical labor-saving devices for the home, the principal products being the Thor electric washing machine and the Thor electric vacuum cleaner, is offering $500,000 7 per cent cumulative sinking fund preferred stock at a par value of $100 a share. These shares are redeemable at $110 per share and accrued dividends, with dividends payable quarterly on the first days of January, April, July and October. This preferred stock offered at $100 a share and accrued dividend from January 1, 1918, carries with it 15 per cent in common stock.

Combined Earnings Report of Standard Subsidiaries.

A comparative and combined earnings statement of the subsidiaries of Standard Gas & Electric Company for the years ended November 30, 1917, and November 30, 1916, has been issued by the bond department of H. M. Byllesby & Company. It shows that nearly 70 per cent of the companies' earnings are derived from electricity, and net earnings for the 12 months ended November 30, 1917, equivalent to 45.22 per cent of the gross earnings. The tabulation is as follows:

Earnings from—	1917.	% of Gross.
Electricity	$13,219,332.27	69.36
Gas	4,366,681.76	22.92
Railway	805,944.54	4.23
Steam	471,282.36	2.47
Telephone	116,989.48	.61
Water	42,485.85	.22
Ice	36,583.23	.19
Gross earnings	$19,059,299.49	100.00
Expense account—		
Operating	$ 8,069,131.61	42.34
Maintenance	1,020,540.43	5.35
Taxes	1,351,708.10	7.09
Expenses and taxes.	$10,441,380.14	54.78
Net earnings	$ 8,617,919.35	45.22

Earnings from—	1916.	% of Gross.
Electricity	$11,724,501.90	69.19
Gas	3,886,754.50	22.94
Railway	743,422.88	4.38
Steam	409,629.36	2.42
Telephone	103,025.54	.61
Water	43,913.59	.26
Ice	34,603.51	.20
Gross earnings	$16,945,851.28	100.00
Expense account—		
Operating	$ 6,573,255.82	38.79
Maintenance	955,398.82	5.64
Taxes	1,126,270.11	6.65
Expenses and taxes.	$ 8,654,924.75	51.08
Net earnings	$ 8,290,926.53	48.92

Toledo Traction, Light & Power Lien Bonds Issued.

The $10,500,000 of 7 per cent bonds being issued by the Toledo Traction, Light & Power Company are secured by first lien on practically all the property, its replacement value being largely in excess of the debt. The bonds are being issued to retire $8,699,000 of first lien bonds which mature February 1 and to cover part of the cost of extensions built during the last few years. Gross and net earnings of this company have increased steadily for years and net is now at the rate of more than twice the interest on these bonds. The bonds will run only two years, the company evidently hoping to refund them at a lower rate in 1920. They are well secured and a most attractive investment.

United States Notes Oversubscribed.

The issue of $400,000,000 of certificates of indebtedness, which closed recently, was heavily oversubscribed, the treasury department has announced. The allotments will be made as soon as all subscriptions are reported. The certificates are payable April 22.

Byllesby 1918 Handbook on Investments.

H. M. Byllesby & Company are preparing for the distribution of a 1918 handbook, concisely describing the investment securities of the various utility companies under their operation and management. The foreword, commenting on the position of Byllesby utilities and the present timeliness for profitable investment in their securities, follows:

"The year 1918 finds us concentrating all our energies to the stupendous task of achieving our part of the great war activities.

"The wealth of the Nation is pledged first to the successful culmination of the war and secondly to the continuous operation of those industries and pursuits which are indispensable to the welfare of the country.

"The enormous cash requirements of the United States Government have restricted the financing of corporate enterprises to such industries as are absolutely essential to the vital needs of the Nation.

"Byllesby utility companies successfully meet the daily requirements of 2,000,000 people and of thousands of industries in 360 cities and towns of sixteen states. We believe an investment in the securities of public utilities is an act of national service. We have every confidence in the continued growth of these properties and in their ability to take care of their obligations and it is this confidence which prompts us to unhesitatingly recommend them for investment.

"We are confident that general conditions brought about by the war will again right themselves and those who have the courage and foresight to invest now, are going to reap the benefit of high interest returns, which will not be obtainable when general peace is declared.

"A comparison of market prices of January, 1918, with those of a year ago and a comparative review of the operations of the properties, reveals the fact that all of these securities are selling at far below their intrinsic worth."

Company Makes Tentative Offer to Pay.

The Puget Sound Traction, Light & Power Company has proposed to the city of Seattle that it will pay $72,443.50, representing two per cent of its gross street car earning for 1917, under the same conditions that payment of $64,387.78 for 1916 was tendered a year ago. In December, 1916, after the traction company had petitioned the public service commission to be relieved of certain of its franchise obligations, including the payment of two per cent of its gross earnings to the city, the paving of rights-of-way and any portion of bridges, a conference with the mayor resulted in an agreement that planking should be done in lieu of paving and that in the event the relief sought for was granted by the Public Service Commission, that the amount of gross earnings tax for that year should be refunded. On January 13, 1917, the company tendered payment of $64,387.78 with the stipulation that litigation started by the city to force compliance with the paving provision be dismissed or withdrawn until final adjudication of its petition for relief. This payment was for 1916 earnings. Council refused to accept payment under these conditions as agreed to at the conference with the mayor in 1915 and the amount returned to the company, the city then bringing a suit to recover the amount. Payment of the 1917 gross earnings tax is now tendered under similar conditions, the tender showing an increase in 1917 over 1916 of $8,056.72. These figures indicate that the earnings of the company's street cars for 1917, amounted to $3,622,175, compared with $3,219,389 for 1916, or an increase of $402,786.

Dividends.

The Commonwealth Power, Railway & Light Company has declared a dividend

of 1½ per cent on the preferred stock to stockholders of record January 28, 1918, payable in scrip, dated February 1, 1918. due on or before February 1, 1924, with interest at the rate of 6 per cent. The directors decided to omit declaration of dividend on the common stock for the present.

J. G. White & Company, Inc., has declared a quarterly dividend of 1½ per cent on preferred stock; J. G. White Management Corporation, 1¾ per cent quarterly on preferred stock; J. G. White Engineering Corporation, 1¾ per cent quarterly on the preferred stock; all payable March 1 to stock of record February 15.

Kings County Electric Light & Power Company, 360 Pearl street, Brooklyn, N. Y., has sent a notice to its stockholders calling attention to the fact that the quarterly dividends paid March 1, June 1, September 1 and December 1, 1917, were declared from net profits accumulated in the calendar year 1916, which were the most recently accumulated undivided profits and surplus.

The board of directors of the Mobile Electric Company has declared the regular quarterly dividend of 1¾ per cent on the preferred stock of the company, payable February 15 to stockholders of record January 31.

Union Carbide & Carbon Corporation has declared a dividend of $1 a share quarterly, payable April 2 to stock of record March 9.

Mobile Electric Company has declared a dividend of 1¾ per cent on preferred stock payable February 15 to stock of record January 31.

Reports of Earnings.

In addressing the stockholders, Alanson P. Lathrop, president of the American Light & Traction Company stated that operations for the year 1917 showed a large increase in the gross business. Gas sales advanced 11.50 per cent over 1916 and electricity 17.94 per cent. The number of passengers carried by the company increased 33.52 per cent. The increase in the total gross business for the period was $2,307,138. Higher operating costs due to war time conditions more than offset these items. Advances in labor and materials compared with 1916 showed an increase of $1,305,000, while taxes, including amount set aside for Federal requirements, advanced by $705,000.

Gross earnings of the Tacoma, Washington, municipal tide flats car line during the period from November 12 to December 31, 1917, were $9573.84, expenses of operation were $7233.66 and the net income was $2340.18, according to figures recently supplied the city council by Controller Fred Shoemaker. The line was operated for the city by the Tacoma Railway & Power Company.

NORTHERN TEXAS ELECTRIC COMPANY.

	1917.	1916.
December gross	$ 294,208	$ 182,357
Net	155,920	81,137
Surplus after charges.	126,969	52,540
Twelve months' gross.	2,582,113	1,930,321
Net	1,165,200	773,243
Surplus after charges.	816,455	426,313

GALVESTON-HOUSTON ELECTRIC COMPANY.

	1917.	1916.
December gross	$ 209,590	$ 176,496
Net	79,941	66,640
Surplus after charges.	41,367	29,780
Twelve months' gross.	2,088,122	1,944,840
Net	703,250	708,732
Surplus after charges.	252,370	269,739

UNITED LIGHT & RAILWAYS.

For twelve months ended November 30:

	1917.	1916.
Total gross earnings.	$2,046,898	$1,849,084
Net after general and federal taxes	1,876,776	1,707,453
Interest and bond discount	689,368	576,005
Balance available for dividends	1,187,408	1,131,448
Preferred dividends	604,941	594,830
Surplus earnings	582,467	536,618
Operating ratio	62.8%	49.5%

EL PASO ELECTRIC COMPANY.

	1917.	1916.
December gross	$ 108,471	$ 117,342
Net	37,256	58,140
Surplus after charges.	30,748	52,805
Twelve months' gross.	1,283,525	1,110,718
Net	491,755	452,154
Surplus after charges.	414,747	393,026

EAST TEXAS ELECTRIC CO.

	1917.	1916.
December gross	$ 85,478	$ 75,472
Net after taxes	41,363	35,761
Surplus	32,041	26,136
Twelve months' gross.	938,074	826,314
Net	421,082	381,892
Surplus after charges.	303,780	274,193

PUGET SOUND TRACTION, LIGHT & POWER COMPANY.

	1917.	1916.
November gross	$ 899,903	$ 731,630
Net	319,306	298,646
Surplus after charges.	115,869	113,964
Twelve months' gross.	9,272,611	8,018,193
Net	3,586,340	2,925,495
Surplus after charges.	1,253,849	715,019

CONNECTICUT POWER COMPANY.

	1917.	1916.
December gross	$ 81,592	$ 70,923
Net	35,214	36,567
Surplus after charges.	16,700	20,064
Twelve months' gross.	870,621	742,686
Net	397,450	373,356
Surplus after charges.	190,189	177,890

EAST ST. LOUIS & SUBURBAN COMPANY SYSTEM.

	1917.	1916.
November gross	$ 329,267	$ 278,467
Net after taxes	105,411	110,448
Surplus after charges.	38,467	47,038
Twelve months' gross.	13,630,797	2,970,054
Net after taxes	1,208,057	1,192,860
Surplus after charges.	428,810	438,595
Balance after preferred dividends	248,810	258,595

NASHVILLE RY. & LIGHT COMPANY.

(Tennessee Railway, Light & Power subsidiary.)

	1917.	1916.
November gross	$ 212,264	$ 199,981
Net after taxes	78,170	79,461
Surplus after charges	37,542	37,147
Twelve months' gross.	2,452,118	2,370,491
Net after taxes	874,940	924,585
Surplus after charges	382,879	414,794
Balance after preferred dividend	257,879	289,794

PERE MARQUETTE RAILWAY.

Operations of the Pere Marquette Railway Company for November and eight months ended November 30, 1917, resulted as follows:

	November	8 months
Operating revenue	$ 1,979,019	$16,253,493
Net operating revenue	486,168	5,110,356
Surplus after taxes and charges	219,018	2,483,227

DETROIT EDISON COMPANY.

Detroit Edison Company's annual report for year ended December 31, 1917, shows a surplus of $2,635,848 after charges, against $2,717,413 surplus in 1916. Surplus is equal to $10.25 a share on $25,691,600 capital stock outstanding. Comparison of income account follows:

	1917.	1916.	1915.	1914.
Gross revenue	$12,279,926	$10,066,786	$ 7,759,932	$ 6,495,815
Net revenue	3,664,410	3,795,693	2,948,713	2,821,064
Surplus after charges	2,635,848	2,717,413	1,848,658	1,938,751

STANDARD GAS & ELECTRIC COMPANY.

	1917.	1916.	Changes.
1917 gross	*$19,059,299	$16,945,851	Inc. $2,113,448
Net	8,617,919	8,290,927	Inc. 326,992

*Year ending November 30.

WEEKLY COMPARISONS OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeiler & Co., Rookery Bldg., Chicago.

Public Utilities—	Div. rate. Per cent.	Bid. Jan. 29.	Bid. Feb. 5.
Adirondack Electric Power of Glens Falls, common	6	15	15
Adirondack Electric Power of Glens Falls, preferred	6	71½	70
American Gas & Electric of New York, common	10+extra	86	87
American Gas & Electric of New York, preferred	6	39½	39½
American Light & Traction of New York, common	..	200	210
American Light & Traction of New York, preferred	6	89	92
American Power & Light of New York, common	4	45	45
American Power & Light of New York, preferred	6	70	69
American Public Utilities of Grand Rapids, common	..	23	20
American Public Utilities of Grand Rapids, preferred	6	56	54
American Telephone & Telegraph of New York	..	104½	108
American Water Works & Elec. of New York, common	..	3¾	3¾
American Water Works & Elec. of New York, particip	7	9	9
American Water Works & Elec. of New York, first preferred	..	59	60
Appalachian Power of Bluefield, common	..	2¼	2¼
Appalachian Power of Bluefield, preferred	7	20	20
Cities Service of New York, common	+extra	210	211
Cities Service of New York, preferred	6	72	74
Commonwealth Edison of Chicago	8	..	108
Comm. Power, Railway & Light of Jackson, common	..	31½	20
Comm. Power, Railway & Light of Jackson, preferred	6	63	48
Federal Light & Traction of New York, common	..	5	5
Federal Light & Traction of New York, preferred	..	24	28
Illinois Northern Utilities of Dixon	6	75	76
Middle West Utilities of Chicago, common	2+extra	25	25
Middle West Utilities of Chicago, preferred	6	60	60
Northern States Power of Chicago, common	ex.div.7	60	60
Northern States Power of Chicago, preferred	ex.div.7	87	87
Pacific Gas & Electric of San Francisco, common	..	34	33½
Pacific Gas & Electric of San Francisco, preferred	6	82½	81
Public Service of Northern Illinois, Chicago, common	7	72¼	74½
Public Service of Northern Illinois, Chicago, preferred	6	85	86
Republic Railway & Light of Youngstown, common	4	22	23
Republic Railway & Light of Youngstown, preferred	6	56	56
Standard Gas & Electric of Chicago, common	..	6	5½
Standard Gas & Electric of Chicago, preferred	6	22	22
Tennessee Railway, Light & Power of Chattanooga, common	..	2½	2½
Tennessee Railway, Light & Power of Chattanooga, preferred	6	10	10
United Light & Railways of Grand Rapids, common	4	27	27
United Light & Railways of Grand Rapids, preferred	6	61	61
Western Power of San Francisco, common	..	11½	11
Western Power of San Francisco, preferred	6	45	45
Western Union Telegraph of New York	extra	90½	91
Industrials—			
Electric Storage of Philadelphia, common	4	49	48
General Electric of Schenectady	8	132	137½
National Carbon of Cleveland, common	8	56½	56¼
National Carbon of Cleveland, preferred	..	130¾	130¾
Westinghouse Electric & Mfg. of Pittsburgh, common	+extra	40¾	41¼
Westinghouse Electric & Mfg. of Pittsburgh, preferred	7	55	60

*Last sale.